

THE BOLETINEAE OF FLORIDA WITH NOTES ON EXTRALIMITAL SPECIES

IV. THE LAMELLATE FAMILIES (GOMPHIDIACEAE PAXILLACEAE, and JUGASPORACEAE)

R. SINGER

As *Lenzites* is close to *Coriolus* in the Aphyllophorales, so, in the Boletineae, some lamellate families come closer to certain genera of the Boletaceae than other tubulose groups, e.g. *Paxillus* seems to be closer to *Gyrodon* than *Strobilomyces* or *Porphyrellus*. The relationship between *Paxillus* and the Boletaceae was actually recognized long ago, but the relationship between the Gomphidiaceae and the Boletineae had been doubted by some mycologists (including Gilbert), and it was necessary to draw attention to the similarities between these groups. (See Ann. Mycol. 40: 555. 1942.) As for the Jugasporaceae, they seem to be intermediate, according to their characters, between the Boletineae and the Agaricineae (*Rhodophyllus*, Rhodogoniosporaceae; *Rhodocybe*, Tricholomataceae). For reasons we shall point out later (p. 548), we have always preferred to consider them as a family of the Boletineae.

The following monograph of the three families named above is written in the same pattern as the three preceding monographs on Florida Boletineae.¹ For a general introduction and a key to the families, the reader is again referred to Part I (Farlowia 2: 97. 1945). In addition to the acknowledgments in my first monograph (*l.c.*), I wish to express my thanks to Dr. L. R. Hesler, University of Tennessee, and especially to Dr. A. H. Smith, University of Michigan, for the loan of important material of *Gomphidius* without which I would never have been able to prepare that genus for *North American Flora*, a manuscript on which the following treatment of the Gomphidiaceae of Florida is based.

GOMPHIDIACEAE R. Maire (1933)

Characters of the family: Pileus glabrous or tomentose or farinaceous, viscid to glutinose or more rarely dry, small to rather large; hymenophore lamellate, consisting of rather thick, decidedly decurrent gills with frequently obtuse edges (less so in subgenus *Chroogomphus*), waxy-subgelatinous to tender-fleshy consistency, and rather thick trama; lamellae subdistant to distant, more or less arcuate, gray to fuliginous when mature; spore print black; spores melleous to gray under the microscope, fusoid to subcylindric, smooth; cystidia large, projecting, usually distinctly incrusting, sometimes colored and with very thick walls (*Gomphidius to-*

¹ Singer, R. The Boletineae of Florida with notes on extralimital species. I. Farlowia 2(1): 97-141. 1945; II. Farlowia 2(2): 223-303. 1945; III. Amer. midl. nat. (in press).

mentosus), numerous to very rarely scattered (when old); trama of the gills more or less bilateral, not always clearly divergent, and very frequently partly interwoven, at least the hymenopodium interwoven but the trama never homogeneously interwoven, nor intermixed, nor regular²); hyphae without clamp connections; stipe versiform, equal or swollen, etc., in most species and specimens with a discolored base which is pink or rich lemon yellow to orange yellow both inside and on the surface; veil present or absent, more often present, and then either entirely glutinous, or tender and fibrillose, or mealy and consisting of a loose pseudoparenchyma (*Cystogomphus*), sometimes forming an annulus; glandulae on the surface of the stipe present in one subgenus of *Gomphidius* (*Laricogomphus*); growing on earth and forming mycorrhiza with conifers, practically all species extratropical.

KEY TO THE GENERA AND THEIR SUBDIVISIONS

- A. Veil consisting of spherocysts. Gen. *Cystogomphus*
- A. Veil, if present, not consisting of spherocysts. Gen. *Gomphidius*
 - B. Context of the pileus ochraceous to orange (though at times in young specimens rather pallid), more rarely salmon to pink; veil constantly present, consisting of strictly parallel, pigment-incrusted hyphae, macroscopically never entirely glutinous, never hyaline; subhymenium filamentous-intermixed and dense to very dense; mediostratum rudimentary in young specimens, indiscernable in adult ones. Subgen. *Chroogomphus*
 - C. Pileus dry to subviscid in wet weather, not shining in dry weather, more or less tomentose to fibrillose. Sect. *Floccigomphus*
 - C. Pileus viscid in wet weather, shining in dry weather, not tomentose and not fibrillose except for traces of the veil on the margin. Sect. *Viscogomphus*
 - B. Context of the pileus white, more rarely pink to salmon, or becoming pink on exposure; veil absent, or consisting of subparallel-subinterwoven, thin hyphae which are not incrusted by pigment, macroscopically hyaline to white, and often entirely glutinous, sometimes blackening with age; subhymenium filamentous-cellular to filamentous, moderately dense; mediostratum of young specimens distinct, less distinct in older ones.
 - D. Veil visible only in the primordium, fugacious and not leaving any traces in adult specimens; dermatocystidia of the stipe fasciculate and the fascicles forming glandulae which make the stipe appear fibrillose or furfuraceous (though these macroscopical characters are not always easy to ascertain); mycelium (of *G. maculatus*) connected with *Larix*-mycorrhiza. Subgen. *Laricogomphus*
 - D. Veil covering the lamellae of the young specimens and leaving more or less distinct traces even in old specimens; dermatocystidia of the stipe not fasciculate, no fibrils or glandulae made up of dermatocystidia present on the surface of the stipe; mycelium in nature not connected with *Larix* but forming mycorrhiza with other conifers. Subgen. *Myxogomphus*
- E. Spores (with the exception of immature and aborted ones) longer than 14 μ . Sect. *Macrosporus*
- E. Spores, or majority of spores, shorter than 14 μ , or just reaching 14 μ . Sect. *Microsporus*

² See also observations for subgenus *Chroogomphus*, sect. *Viscogomphus*, p. 529.

Cystogomphus Sing., Ann. Mycol. **40**: 51. 1942.

Characters of the genus: these are evident in the key above. Type species *Cystogomphus Humblotii* Sing. No species is recorded in Florida.

Gomphidius Fr., Epicrisis, p. 319. 1938.

Characters of the genus: these are evident in the key above. Type species *Gomphidius glutinosus* (Schaeff. ex) Fr.

Subgen. **Chroogomphus** Sing., (in print).

Characters of the subgenus: these are evident in the key above. Type species *Gomphidius rutilus* (Schaeff. ex Fr.) Lundell & Nannf.

Sect. **Floccigomphus** Imai, Jour. Fac. Agr. Hokkaido Imp. Univ. **43**: 285. 1938.

Characters of the section: these are evident in the key above. Type species *Gomphidius tomentosus* Murr. Other species *G. sibiricus* Sing.; *G. leptocystis* Sing. In Florida none of these occurs.

Sect. **Viscogomphus** Imai, Jour. Fac. Agr. Hokkaido Imp. Univ. **43**: 284. 1938.

The characters of this section are obvious in the key above. The type species is the same as in subgenus *Chroogomphus*.

There have been various and seemingly controversial statements concerning the subhymenial and tramal structure of this section as compared with other sections. As for the trama, Fayod (1889) says it is bilateral quite generally in *Gomphidius*, and expresses surprise that De Seynes' figures do not show any bilateral trend. Lohwag (1937) finds the trama typically bilateral (truly bilateral as we call it in this paper) in *G. glutinosus*, and not distinctly bilateral, becoming irregular in *G. rutilus*. Elrod and Blanchard (1939) studied *G. maculatus* and found that the trama is "slightly and loosely interlaced, with a tendency toward a subparallel condition in many places. There is no sign of a differentiated mediostratum and laterostratum." In regard to the subhymenium the situation is still more obscure. Fayod (*l.c.*) says there is none. Lohwag (*l.c.*) and Singer (1942) state that there is one, and that it is pseudoparenchymatic in *G. rutilus*, and filamentous in *G. glutinosus*. Elrod and Blanchard (1939) and also Singer (1938) state that it is filamentous in *G. maculatus*. There is in all species, no doubt, a more or less definite layer immediately beneath the hymenium, but more recent re-examination by the writer tends to modify the above statements, and partly reverse them. It is true that in a not too thin section of the lamella of *G. vinicolor* the subhymenium appears to be coarsely cellular, but more detailed examination of the base of the hymenium shows a dense tissue of strongly interlaced, curved, irregular, strongly coherent hyphae which look cellular where they run for a short distance in a vertical direction. However, very few of the individual hyphae are short enough to be called subisodiametric and then they are very small, or very irregular, *e.g.* the widened hyphae from which two

branching hyphae arise, or the basal cells of the basidia. The subhymenium is not well differentiated from the underlying formation, and, in a sense, it may be stated that there is none. If we reserve the name subhymenium for a thin set of hyphae, continuing the basidia from their base downward, we cannot call it pseudoparenchymatic. *It is filamentous-intermixed.* As for the subhymenium of *G. glutinosus*, we may say that on superficial examination it always appears to be filamentous, but when the subhymenial cells are examined carefully and individually, they frequently turn out to consist partly of chains of very small globose bodies, and the same condition has been observed recently by the writer in *G. maculatus*.

The trama proper is not *a priori* different in *G. vinicolor*, *G. glutinosus*, *G. roseus*, and *G. maculatus* (the hymenophoral anatomy of *G. rutilus* does not differ from that of *G. vinicolor*). The difference pointed out by Lohwag and Peringer (1937) is not so striking, and more a matter of degree and of individual development. The mediostratum of *G. vinicolor* is very strongly reduced, so much so that no darker zone is seen in the pallid middle layer, called, as a whole, mediostratum by the above-cited authors. The irregular, interlaced accompanying zone between this and the subhymenium is called lateral stratum by all authors though I should think that it would rather deserve the name hymenopodium, since most of the looser central portion of the trama (Lohwag and Peringer's mediostratum) actually corresponds to the loose lateral stratum of the boletes. This will also make understandable the complicated tramal structure of *G. glutinosus*. In this latter species, we found a well-developed, melleous mediostratum, and there is no choice, in this case, but to call the hyaline looser layers at its sides the lateral stratum. The next-following layer between the lateral stratum and the subhymenium proper differs from the lateral stratum in being again more interlaced and dense. This layer is neither a part of the lateral stratum nor a part of the subhymenium. It is the hymenopodium. Lohwag and Peringer (*l.c.*) in the case of *G. glutinosus*, do not distinguish between this and the subhymenium proper, and, consequently, what they call subhymenium is the subhymenium plus the hymenopodium.

The gradual difference, therefore, between the trama of *G. glutinosus* and *G. vinicolor* (and *G. rutilus*) consists in the stronger or weaker development of the mediostratum proper on one hand, and the more or less decided tendency toward an irregular, interlaced condition in all or some layers on the other. It seems that other species may be intermediate between these extreme cases, for in my notes I described the trama of *G. roseus* exactly as it is in *G. glutinosus* though without mentioning the existence of a mediostratum, and as we saw above, Elrod and Blanchard did the same in the case of *G. maculatus*. However, it is obvious that the structure of the trama in the Gomphidiaceae, as in general in most Boletineae, is subject to drastic changes during the individual development of the carpophore, and our specimens may have been somewhat too old. Though the photographs published by Elrod and Blanchard do not show much as far

as the exact structure of the various layers goes, Lohwag and Peringer's figures 11–13 show this difference in different stages.

Another important fact not indicated in the literature on Gomphidiaceae, is the change in color of the spores when these are preserved in the herbarium for a considerable time. There is a specimen called *Gomphidius viscidus* [described here as *G. rutilus* (Schff.) Fr. ssp. *alabamensis*] collected ninety-five years ago and preserved in the Curtis Herbarium (FH) with a spore print on blue paper attached to it. The spores of the print are now ferruginous macroscopically, and greenish melleous under the microscope. This discoloration should be kept in mind when older herbarium material is described. I have never seen any of Fayod's specimens of *Gymnogomphus* Fay., but the description suggests that some old specimens of *G. rutilus* or of its group were misinterpreted and a new genus was created because of this fact.

KEY TO THE SPECIES

- A. Mycelium pink-salmoneous; base of the stipe usually not markedly discolorous (yellow).
 - B. Middle portion of the cystidia strongly thick-walled, apex and base thin-walled. 1. *Gomphidius vinicolor* (in Florida: ssp. *jamaicensis*)
 - B. Middle portion of the cystidia not markedly thick-walled, wall of the cystidia nearly equal, thin to very slightly thickened (not more than $1.7\ \mu$ at most). *Gomphidius ochraceus*
 - A. Mycelium never pink-salmoneous, but pale yellowish white to "Isabella color"; base of the stipe frequently markedly discolorous, yellow.
 - 2. *Gomphidius rutilus* (in Florida: ssp. *alabamensis*)
1. ***Gomphidius vinicolor*** Peck ssp. ***jamaicensis*** (Murr.) Sing. comb. nov.
Gomphidius jamaicensis Murr. Mycologia 10: 69. 1918.
Gomphidius alachuanus Murr., Jour. Elisha Mitch. Sci. Soc. 55: 367. 1939.

PLATE I, FIG. 4–7.

Pileus between "Natal brown" and "Army brown" with some tints of "light vinaceous cinnamon" to "Mikado brown" intermixed, or almost "chestnut," viscid, during dry periods "liver brown," "carob brown," or sometimes somewhat darker than these and shining, sometimes pallescent on the disk and becoming "Kaiser brown" or even "ferrugineous," glabrous, naked, smooth, conic-convex, then convex, eventually usually more or less flattened, or with depressed center, obtuse, (24)–50–(98) mm. diam. — *Hymenophore* between "Prout's brown" and "mummy brown," initially dirty ochraceous-alutaceous, eventually black from the spores, the lamellae broadest in the middle (4–10 mm.), subclose to subdistant, arcuate, decurrent, intermixed (one lamellula after either one or two through-lamellae), slightly transversely venose, only occasionally and very sparsely forked; spore print black. — *Stipe* "light vinaceous cinnamon" to "buff pink," or "vinaceous rufous," the base usually "cinnamon" to "clay color," "light ochraceous buff," or "ochraceous buff," sometimes at places becoming "Jasper red" or "orange cinnamon" to "cacao brown," not viscid, glabrous

except for the veil, smooth but more or less grooved when drying, naked, gradually tapering downward, or subequal, solid, 36–100 x 4–15 mm.; veil either forming a definite, fibrillose-woolly, narrow annulus which is concolorous with the remaining surface of the stipe, or reduced to a mere fibrillose zone at the apex of the stipe; mycelium pink. — *Context* of the pileus and upper portion of the stipe “pale ochraceous salmon” to “ochraceous salmon,” or “pinkish buff” in pileus and “cinnamon buff” in upper part of stipe, in the base “primuline yellow” with a tinge of “yellow ocher” or “clay color,” often somewhat umber immediately below the cuticle, fleshy, rather firm, not as soft and watery as in *G. glutinosus*; odor none, or agreeable when quite young, recalling apples or apple sauce; taste mild.

Spores melleous-grayish to gray, varying from a pure cinereous to fuliginous gray, ellipsoid to fusoid, not cylindric, smooth, (in carpophores with the spores of small average size, the short spores are usually the broadest, and the long ones the slenderest), 17–21.8 x 5.8–8 μ ; *basidia* (2)–4-spored, 34–46 x (8.2)–9.2–13 μ ; *cystidia* numerous, on edge as well as on sides of lamellae, slightly incrustated on the inside of the walls in many of them, the incrustation melleous, and in almost all of them there is a strong resinous or occasionally granular, fulvous-castaneous incrustation that covers the apices, otherwise smooth, thick-walled, the wall hyaline, thinner or quite thin at the apex which is frequently capitate, rarely clavate, and always broadly rounded, cylindric or slightly fusoid below, and there the walls reaching 2–5.5 μ in diameter but becoming thin near the very base, the entire length varying between 115 and 150 μ , the diameter from 13.5 to 22.5 μ , the base reaching into the lateral stratum, the upper portion projecting well beyond the level of the sterigmata; *subhymenium* filamentous-intermixed; *trama* consisting of an indistinct mediostratum reduced to a central string of a few parallel or subinterwoven hyphae which are all hyaline and cylindric, but most of the trama proper (i.e. excluding the hymenopodium) formed by a hyaline, loosely arranged, partly subirregular layer that with age becomes homogeneous and increasingly irregular while any trace of a mediostratum disappears; *hymenopodium* obscured and thickly covered by an adhesive (sordid melleous brown) pigment that precipitates in form of an amorphous intercellular pigment when the preparation is boiled in 10% KOH, differing in this regard from the trama proper, and differing, also, in its much denser arrangement, the hyphae being more variable in diameter and running in all directions to form a subintermixed broad zone along the subhymenial layers; all *hyphae* without clamp connections; *pellicle* of repent, subparallel-interwoven, with fulvous-castaneous incrustation, elongate, clampless hyphae; *mycelium* consisting of filamentous hyphae which are beset with button-like ornamentations.

Chemical reactions: **KOH** on pileus, little reaction; on context, between “pale rosolane purple” and “thuilite pink,” becoming “spinel red”; in base, “rich brown.” — **NH₃**—vapors on context, “liseran purple” and “pale rosolane purple”; in base olive. — **NH₄OH** on pileus, little reaction; on

context between "pale rosolane purple" and "thuilite pink," becoming "spinel red"; in base brownish. — H_2SO_4 , little reaction but the treated portions of the base becoming deep fulvous yellow when dried subsequently. — FeSO_4 in all parts, "deep olive" to "dark olive."

Habitat: In woods, in Florida under *Pinus taeda*, possibly also *P. australis*, and *P. palustris*, but not observed in pure stands of any of the latter species; on sandy soil, gregarious, fruiting from November to January.

Distribution: North Florida and Alabama, also in the West Indies (Jamaica).

Material studied: **Fla.**: Alachua Co., Gainesville, *Murrill et al.* *F* 10213, *F* 18431, *F* 20040 (all FLAS, *det.* Murrill); Planera Hammock near Gainesville, *Murrill et al. det.* *Murrill* *F* 19517, *F* 20086 (FLAS) **type** of *G. alachuanus*, Newnan's Lake, East of Gainesville, *West & Murrill* *F* 18402 (FLAS); my own collections compared with the type and partly from the type locality: *F* 1657, *F* 1657a, *F* 1657b, *F* 1657c, *F* 1657d, *F* 1657e (all FH). — **Ala.**: Lee Co. Auburn, Fall 1897, *F. S. Earle & C. F. Baker* (*G. viscidus*) (NY). — **Jamaica, W.I.**: Cinchona, in 5000 ft. elevation, *Earle* (352), **type** (NY).

This species is divided into several geographic races and mycoecotypes (in the sense of Singer, *Sovietsk. Botan.* 1940, (5-6):262-269). The subtropical (*G. alachuanus*) and tropical-montane (*G. jamaicensis*) form, having subclose to subdistant lamellae and forming mycorrhiza with pines of the section *Australes*, should properly be called ssp. *jamaicensis* while the northern and western forms occurring with such pines as *Pinus resinosa*, and *P. radiata*, and differing morphologically in having more distant lamellae and frequently umbonate pileus, should be distinguished under separate subspecific names. The northern subspecies of *G. vinicolor* Murr. has the same characteristic cystidia with thick walls in the middle portion as has been observed in the southern form. It should not be confused with *G. ochraceus* Kauffm. and allied forms such as *G. superiorensis* Kauffm. & Sm., which also have pink mycelium and similar colors under certain conditions and in certain stages, but lack the thick cystidial walls. *G. tomentosus* Murr., which has thick-walled cystidia, has the walls nearly equally thick over the entire length of the cystidia, and not merely in the middle. *G. rutilus* and allied forms (ssp. *alabamensis*, the form called *G. furcatus* by Kauffman *non* Peck) is easily distinguished by the color of the mycelial tomentum and the thin-walled cystidia.

2. **Gomphidius rutilus** (Schaeff. ex Fr.) Lund. & Nannf., *Fung. Exs. Suec.* 409. 1937.
Agaricus rutilus Schaeff. ex Fr., *Syst. Mycol.* 1: 315. 1821.
Cortinaria rutila S. F. Gray, *Nat. Arr. Brit. Pl.* 2: 629. 1821.
Gomphidius viscidus (L. ex) Fr., *Epicrisis*, p. 319. 1838.
Paxillus pubescens Ellis, *Bull. Torr. Bot. Cl.* 6: 76. 1876. (= ssp. *alabamensis*)
Gomphidius testaceus (Fr.) Britz., *Hymen. Südbay.* 4: 133. 1885. (= var. *testaceus*)
Gomphidius litiginosus Britz., *Hymen. Südbay.* 9: 14. 1893. (= var. *litiginosus*)
Gomphidius alabamensis Earle, *Torreyia* 2: 54. 1902. *nomen nudum* (= ssp. *alabamensis*)
Gomphidius viscidus forma *columbiana* Kauffm., *Mycologia* 17: 122. 1925.

Ssp. **typicus**.

The type subspecies, the most common *Gomphidius* in Europe and in parts of the Rocky Mountain region, does not occur in Florida. It differs only slightly from the following subspecies (*alabamensis*) in having the pileus almost constantly umbonate, and in its geographic area.

Var. **testaceus** Fr., Epicr., p. 319. 1838 (*ut varietas G. viscidii*)

This is a small umbonate form with very light, almost white mycelium, and with the stipe lacking the yellow color of the surface and of the context. I have collected it under pines in mixed beech woods in Europe, but not in this country. Good typical specimens are preserved in the Hoehnel Herbarium (FH), from Tullnerbach-Pressbaum, Wiener Wald, Austria (*F. v. Höhnel B 1467*). The specimens described and illustrated under the name of *Gomphidius viscidus* var. *testaceus* Fr. in *Icones Farlowianae*, pl. 70, are a form of *G. ochraceus* Kauffm. *G. viscidus* fa. *testacea* Kavina seems to belong either to var. *pulcher* or var. *fulmineus*.

Var. **pulcher** Killerm. Denkschr. Bay. Bot. Ges. **21**: 58. 1940 (*ut varietas G. viscidii*)

Var. **litigiosus** (Britz.) Sing. comb. nov.

These two varieties, with differently colored pilei, are both described from Bavaria, not reported from America.

Var. **fulmineus** Heim, Treb. Mus. Ciènc. Nat. **15**: 68. pl. 1, fig. 3. 1934 (*ut varietas G. viscidii*)

This was described from Spain; it is possibly specifically different.

Kauffman described a f. *columbiana* which, as he thought, represents the American form of *G. viscidus* (*G. rutilus* ssp. *typicus* in our nomenclature). However, the examination of his herbarium shows that he mixed two different species under this name, one being an umbonate form of *G. ochraceus*, the other (including the type specimen) being *G. rutilus* ssp. *typicus*. It appears that Kauffman was under the impression that the European *G. rutilus* always is a large plant, which is definitely not true. Thus there remain only two differences between the European and the American form which escaped Kauffman. One is the frequently brighter color of the base of the American specimens, a character that aside from its vagueness does not seem to be quite constant. The other is a phytosociological character which could possibly be physiological: the American form is associated with pines of the series *Insignes* while the European form is associated with pines of the series *Lariciones*. If it could be demonstrated by experiments that the European form does not form mycorrhiza with *Pinus contorta* as readily as it does with *P. silvestris*, it would make the American form a mycoecotype lacking morphological differences (comparable with the races of rusts). However, as long as such physiological differences have not been shown, I prefer to list f. *columbiana* as a plain synonym of *G. rutilus* ssp. *typicus*.

Subsp. **alabamensis** (Earle *ex*) Sing. subsp. nov.

Gomphidius alabamensis Earle, Torreyia 2: 54. 1902 (*nomen subnudum*)

Paxillus pubescens Ellis, Bull. Torr. Bot. Cl. 6: 76. 1876.

PLATE I, FIG. 1-3.

Tomento myceliali cremeo-albo vel melleo-isabellino; basi plerumque laete flavo in siccis; umbone plerumque nulla; cystidiis tenuitunicatis, incrustatis; ceterum *Gomphidio rutilo* et *G. vinicolori* analogus.

Pileus "light russet vinaceous," "cinnamon buff," "vinaceous cinnamon," "testaceous," sometimes reaching "chocolate," "Hay's brown" or "dark vinaceous brown," assuming at times colors like "pecan brown" or "purplish vinaceous" after drying, usually a lighter reddish-brown in dried specimens than *G. jamaicensis*, glabrous, more rarely with cracking pellicle showing orange flesh between the fragments, viscid, naked, shining when dry, convex to plane, eventually often depressed and turbinate, obtuse, rarely indistinctly umbonate, 30-100 mm. broad, mostly between 30 and 70 mm. — *Lamellae* "avellaneous," "clay color," "ochraceous tawny," later "testaceous," "snuff brown," or "sayal brown," and finally darker sooty from the spores, arcuate, then descendant, broad, subclose to distant, entire, thick, inserted with very short ones, occasionally some forked near the stipe, decurrent. Spore print "hair brown" to "deep grayish olive" in thin to moderate layer, very nearly black in good print. — *Stipe* varying from sordid whitish to "Congo pink" or subconcolorous with the veil which is "ochraceous buff" or "capucine buff," or streaked with vinaceous brown to almost tawny, with a bright yellow color very often at the very base of the dried stipes, mycelium cream-white to melleous-yellow or "Isabella color," strigose, the upper surface fibrillose and often showing a cortina-like annulus at the apex, glabrescent below, the veil often spurious, the outer fibrils somewhat slippery-sticky-subviscid in very wet weather but never gelatinous, inside solid, the shape equal with attenuate base, or fully equal and cylindric, or occasionally compressed, or tapering from the apex downward, straight or curved, 25-90 x 8-18-(40) mm. — *Context* of the pileus thick in the center, thin on margin, varying from almost white (though usually showing a slight brownish-orange tinge) to "buff pink," soft; of stipe "Congo pink" to subconcolorous with the pileus, the base mostly more or less yellow inside. *Odor* none to slight. *Taste* mild.

Spores (16)-18-21 x 5.8-6.5 μ , subcylindric-fusiform, smooth, melleous, grayish-melleous; *basidia* 4-spored, 40-55 x 11-12.8 μ ; *cystidia* abundant, cylindric to cylindric-ventricose, or subcapitate, with narrowed base and rounded apex, incrustated or more rarely not incrustated, with or without granular contents, 95-150 x 12-18 μ , on sides and edges; *subhymenium*, *hymenopodium*, *lateral stratum*, and *mediostratum* as in *G. jamaicensis* (the subhymenium perhaps very slightly looser); *cuticle* of incrustated repent filamentous hyphae; *hyphae* without clamp connections.

Habitat: In mixed and pine woods under *Pinus* (species of the series *Insignes* and *Australes*), terrestrial, gregarious, fruiting from October to January.

Distribution: Maryland to South Carolina and west to Alabama and Tennessee, south to north Florida. In Florida rare, and observed only once in the western part of Alachua Co.

Material studied: **Fla.:** Near Seven-Mile-Church, 7 mi. west of Gainesville, January 8, 1940, *W. A. Murrill & J. R. Watson*, det. Murrill (*G. alachuanus*) (ex Herb. Erdman West, NY). — **N.J.:** Newfield, Oct. 10, 1887, on ground in pine woods, **Authentic** material of *P. pubescens* Ell. (NY). — **Md.:** South River near Annapolis, Oct. 6, 1919, *J. R. Morris*, comm. *H. A. Kelly* (276), det. L. C. C. Krieger (*Gomphidius spec.*) (MICH); Takoma Park, Oct. 12, 1918, *Kauffman* (*G. furcatus*). — **N. C.:** Chapel Hill, Oct. 1912, *W. B. Cobb* 582 (NY). — **S. C.:** Society Hill, *Curtis* 2855 (FH). — **Tenn.:** Ball Camp Pike, Nov. 1937, *Hesler & Sharp* 10986, det. A. H. Smith (*G. viscidus*) (MICH); Dec. 25, 1941, *L. R. Hesler* (*G. viscidus* f. *columbiana*) 14120 (MICH); near Clinton, Nov. 11, 1934, *L. R. Hesler* 7792, det. A. H. Smith (*G. vinicolor*) (FH, MICH). — **Ala.:** type of *G. alabamensis*, Auburn, Dec. 1900, *E. S. & F. S. Earle* (2845) (NY).

Earle published *G. alabamensis* in a key to the species of *Gomphidius*, but without a formal description. The characters given in the key do not determine the species as such, but notes with some of his specimens which he called *G. viscidus*, and the specimen which we consider the type of *G. alabamensis*, do not leave any doubt as to what Earle had in mind when he used the binomial *Gomphidius alabamensis*. The specimens of *G. furcatus* Peck, however, belong rather to *G. maculatus* than to this form, and we think, therefore, that Kauffman was wrong in identifying *G. alabamensis* with *G. furcatus*.

EXTRALIMITAL SPECIES

Gomphidius ochraceus Kauffm., *Mycologia* 17(3): 119. 1925.

Gomphidius superiorensis Kauffm. & Smith, *Papers Mich. Acad. Sci. Arts & Lett.* 17: 170. 1933. (a variety)

A polymorphous species, close to *G. rutilus*, not occurring in Florida.

Subgen. **Laricogomphus** Sing., (in press)

Characters of the subgenus: these are evident from the data in the key. Type species *G. maculatus* (Scop. ex Fr.) Fr. Not occurring in Florida.

Subgen. **Myxogomphus** Sing., (in press)

Characters of the subgenus: these are evident from the key. Type species *G. glutinosus* (Schaeff. ex Fr.) Fr.

Sect. **Macrosporus** Sing., (in press)

Characters of the section: these are evident from the key. Type species *G. glutinosus* (Schaeff. ex Fr.) Fr. This and the other species of this section, viz. *G. septentrionalis* Sing., *G. nigricans* Peck, *G. Smithii* Sing.,

G. subroseus Kauffm., *G. roseus* (Fr.) Karst. do not occur as far south as Florida.

Sect. **Microsporus** Sing., (in press)

Characters of the section: see key. Type species *G. oregonensis* Peck, a western species. Another species may occur in Europe, none in Florida.

SPECIES EXCLUDENDAE

Gomphidius foliiporus Murr.

This is *Phylloporus rhodoxanthus* ssp. *foliiporus* (Murr.) Sing.

Gomphidius rhodoxanthus (Schwein.) Sacc.

This is the American type of *Phylloporus rhodoxanthus* (Schw.) Bres.

PAXILLACEAE R. Maire (1902)

Characters of the family: pileus subtomentose to tomentose, sometimes viscid, small to large, the margin initially inrolled; hymenophore lamellose, but the lamellae very frequently connected by anastomosing veins and ridges, or the sides of the lamellae venose-rugose, more rarely the anastomoses broad and numerous and then the hymenophore resembles that of *Merulius*, arcuate, usually rather narrow, yellow, orange, or light tan to brown; spore print from nearly white to chamois or brownish; spores rather small to medium (3–11.5 μ long), smooth, ovoid, subglobose, ellipsoid or oblong-ellipsoid; cystidia present or absent; trama more or less bilateral; hyphae constantly with clamp connections; stipe very frequently eccentric to lateral or wanting; veil, said to be present in *Paxillus argentinus*, mostly none. Habitat: on earth or on wood, or on sawdust, rarer in the tropics but not entirely confined to extratropical regions, not forming mycorrhiza with specific flowering plants.

The Paxillaceae are closely related to the Boletaceae, especially the genus *Gyrodon*. Aside from the more individualized lamellae (even if they are connected by anastomoses), the more involute margin of young specimens, and the biological differences (*Gyrodon* and most of the Boletaceae being mycorrhizal fungi while the Paxillaceae do not seem to be dependent on symbiosis with specific forest trees, which does not mean that they will never and under no circumstances whatever form anything comparable with mycorrhiza-relationship), there are some minor differences that separate this family from *Gyrodon*. There is, for example, a slight but distinct difference in the chemical reactions (see the descriptions of the species). The greenish-yellow color of the hymenophores in *Gyrodon* is indicative of its close relationship with the Boletaceae. There is also the occurrence, in some species of *Gyrodon*, of autoxidation causing a blue discoloration of the hymenophore and the flesh. This latter reaction is, although not a constant feature of all *Gyrodon*, a character common to

many groups of the Boletaceae, while in the Paxillaceae this blue discoloration is constantly absent. There also appears to be some difference between the structure of the tube walls of *Gyrodon* and the trama of the lamellae in *Paxillus*. In the former, the mediostratum is somewhat denser and somewhat colored while the lateral stratum is distinctly divergent and hyaline in young material. In *Paxillus*, we found the lateral stratum of our sections definitely strongly interwoven, not clearly diverging, and of a rather different aspect when compared with the lateral stratum of the *Gyrodon* spp. — so different, indeed, that it is possible to consider it as non-homologous with the lateral stratum of the Boletaceae. Instead, the homology is with the hymenopodium of the Gomphidiaceae (see p. 529), which, however, may be difficult to prove, since the middle layer is always homogenous. In this family, as well as in the Gomphidiaceae, the structure of the hymenophore trama changes strongly while the carpophores mature.

I cannot see any good reason for splitting the genus *Paxillus* into several genera, merely on the, for the most part imaginary, differences in tramal structure. These species are otherwise so similar, exactly as the *Gomphidii*, that there is no doubt about their close natural affinities. This is confirmed by the chemical reactions registered by the author. One has only to compare the reactions of *Paxillus involutus* (see Ann. Myc. 40: 58. 1942) with these of *P. panuoides* (see this paper, p. 542). *Crepidotus*, which has been compared with *Paxillus panuoides*, belongs in an entirely different sphere of affinities, being very close to *Ripartites* (which also has been considered as belonging to *Paxillus* by Quélet, Ricken, and others), and some other genera. *Phylloporus* is too close to certain Boletaceae, especially *Xerocomus*, to be retained in the Paxillaceae.

The Paxillaceae and the Gomphidiaceae are no doubt related, as may be expected of two lamellae-bearing families within the suborder Boletineae. Their tramal structure has some analogies. But biologically, in spore color, spore size, in chemical characters, and, most important, in clamp connections, they are consistently different. In many ways the Gomphidiaceae are comparable with the Strobilomycetaceae, and the Paxillaceae with the Boletaceae.

KEY TO THE GENERA, SECTIONS, AND SPECIES KNOWN TO THE AUTHOR

- A. Spore print at least "chamois" (Ridgway), or somewhat deeper brownish; lamellae more or less anastomosing, at least in some portions of the hymenophore.
Gen. *Paxillus*
- B. Spores up to 7.5 μ large; cystidia none.
 - C. Stipe present, large, tomentose. Sect. *Atrotomentosi*
 - D. Trama of the lamellae lilac, in NH_4OH blue.
Paxillus polychrous
 - D. Trama of the lamellae not as above. *Paxillus atrotomentosus*
 - C. Stipe present, and then lateral and short, or absent.
Sect. *Panuoides*

E. Spores $3.8-6 \times 3-4.5 \mu$. Odor none or not remarkable.

3. *Paxillus panuoides*

E. Spores $3-4 \times 1.7-2 \mu$. Odor sometimes persistent, disagreeable.

Paxillus Curtisii

B. Most spores more than 7.5μ long; cystidia present.

Sect. *Involuti*

Paxillus involutus

A. Spore print almost white (somewhat cream colored in thick layer); lamellae not or little anastomosing (though strongly forked), not venose on their sides.

Gen. *Hygrophoropsis*

F. Spores $4.8-8 \times 2.7-4.8 \mu$; basidia $19-40 \times 5-9.5 \mu$; pileus 35-85 mm. in diameter; stipe central or somewhat eccentric, very rarely strongly eccentric to lateral; habitat in coniferous woods or in mixed woods under conifers, on moss beds, or on coniferous wood, or on naked earth.

5. *Hygrophoropsis aurantiaca*

F. Spores $3.3-4.8 \times 2.5-3.3 \mu$; basidia $16-20 \times 3.7-6.8 \mu$; pileus up to 31 mm. in diameter; stipe strongly eccentric, lateral, or entirely wanting; habitat on sawdust, in hollow trunks (e.g. of *Nyssa silvatica*) but not on coniferous trunks, also occurring on old frondose logs in dense hammocks.

4. *Hygrophoropsis tapinia*

Paxillus Fr., Gen. Hymen., p. 8. 1836.

Ruthea Opat., Comm. Bol., Wieg. Arch. 2: 4. 1836.

Tapinia Karst., Hattsv., p. XXIII. 1879.

Tapinella Gilbert, Bolets, p. 67. 1931.

Rhymovis Rabenh., Kryptogamenfl. 1: 453. 1844.

Paxillopsis Gilbert, Bolets, p. 86. 1931 (*nom. nud.*), *non* Lange, Fl. Agar. Dan. 4: 47. 1939.

Plicaturella Murr., N. Amer. Flor. 9: 172. 1910 (*sec.* Murrill).

Characters of the genus: these are evident in the key above. Type species, *P. involutus* (Batsch ex Fr.) Fr. The only species thus far observed in Florida is *P. panuoides*.

The nomenclatorial problem in the case of the genus *Paxillus* is a rather simple one. The genus *Paxillus* and the genus *Ruthea*, based on the same plants, were both proposed in 1836, and it certainly was a good idea to put *Paxillus* on the list of *nomina generica conservanda* as proposed by R. Maire to be accepted by the next Botanical Congress, since it may turn out that Opatowski's little-known name has a few days' priority over the generally accepted name *Paxillus*. Unfortunately, Gilbert's chapter about this family has caused many wrong citations and erroneous conceptions due to some inaccuracies in his book "Les Bolets." In his chapter on the "Histoire Taxonomique du Genre *Paxillus*" (p. 64-69), he says: "Persoon . . . a explicitement créé le genre *Rhymovis* sur le *P. involutus*, pour les seules espèces étroitement affines aux Bolets. Quoique puisse en dire Fries . . . , ce genre *Rhymovis* a la priorité. . . . Il est bien curieux de constater que Earle (1909) et Murrill ne l'aient pas reprise." Persoon, however, did not validly describe a genus *Rhymovis* though he may have had the intention of doing so in the future. "Si plures species," he

says (*Mycologia Europaea* 3: 63), "inveniuntur, huic [*i.e.* *Agaricus involutus*] conformes, tunc ex iis genus distinctum efformari posset, *Rhymovis*³ forte denominandum." It is inconceivable that anyone who has read this could possibly consider *Rhymoxis* as a published genus. It must be assumed that Earle and Murrill *did* read what Persoon said. They, therefore, knew that *Rhymovis* was not published before 1844 by Rabenhorst, *i.e.* eight years after Fries published *Paxillus*. Gilbert continues: "Berkeley (1836) crée lui aussi, sur *P. involutus*, un genre *Tapinia* qui sera repris comme sous-genre par Fries (1838) . . . Karsten (1879) . . . démembrement ce *Paxillus* (= *Tapinia*): *Paxillus* pour le *P. involutus* et ses affines, et *Tapinia* pour le *T. panuoides*. . . . Il est donc nécessaire de rejeter le terme générique *Tapinia*, d'ailleurs illégalement employé." If we check on Gilbert's "Histoire" again, it turns out that Berkeley in 1836 did not use *Tapinia* as a genus but as a subgenus. Karsten's *Tapinia*, therefore, is legal, though in my opinion not worthy of generic distinction. This whole situation was clear enough in the synonymy given in *North American Flora* 10(3) : 146–147. 1917, and did not need to be "embrouillé" as late as 1931.

Sect. **Atrotomentosi** Sing. sect. nov.

Stipite praesente, vellereo; sporis parvulis; cystidiis nullis.

Characters of the section evident from the key above and the Latin diagnosis. Type species *P. atrotomentosus* (Batsch ex Fr.) Fr. Other species *P. polychrous* Sing. None of them found in Florida.

P. atrotomentosus is a well-known species, frequent in North America but not reaching Florida. Specimens from New Hampshire show the following chemical reactions, recorded here for comparison with *P. panuoides*. **NH₄OH** on the surface of the pileus coloring the tomentum and the pallid surface of the context, "dull lavender" to "slate purple" but leaving the cuticle proper unchanged brown in most cases (at least in old specimens); "dull lavender" to "slate purple" on the context of the pileus and the stipe but changing more slowly than on the surface of the pileus. — **KOH** on the surface of the pileus, a dark spot with a violet to lilac ring; on the context of the stipe, greenish; on the tomentum of the stipe, blackish. — **H₂SO₄** on the surface of the pileus where previously treated with KOH or NH₄OH becoming "yellow ocher," then "Buckthorn brown" in a few seconds, changing more slowly and more indistinctly at places where not previously treated with KOH or NH₄OH. — **FeSO₄** darker brown, and eventually greenish black on the pileus, and dull greenish gray on the context of the stipe, eventually blackish.

Sect. **Panuoides** Sing. sect. nov.

Pileo subsessili.

³ "*Rhymovis*" was a printing error, and was corrected to *Rhymoxis* by Persoon in the Errata corrigenda of his *Mycologia Europaea*, v. 3, a fact which escaped Rabenhorst who is the only one who used Persoon's name.

Characters of the section evident from the key above and the Latin diagnosis. Type species *P. panuoides* (Fr. ex Fr.) Fr., the only species known in Florida. Another species is *P. Curtisii* Berk. *apud* B. & C.

3. ***Paxillus panuoides*** (Fr. ex Fr.) Fr., *Epicrisis*, p. 318. 1938.

- Agaricus panuoides* Fr. ex Fr., *Syst. Mycol.* 1:273. 1821.
Agaricus lamellirugis D. C. ex Secr., *Mycogr. Suisse* 2: 457. 1833.
Agaricus croceolamellatus Let., *Ann. Sci. Nat. sér. II.* 3: 94. 1835.
Cantharellus Dutrochetii Turpin *apud* Mont., *Ann. Sci. Nat., sér. II.* 5: 342. 1836.
Rhymovis panuoides Rabenh., *Kryptogamenfl.* 1: 453. 1844.
Paxillus rudis Berk. & Curt., *Ann. Mag. Nat. Hist. ser. III.* 4: 296. 1859.
Paxillus ligneus Berk. & Curt., *Jour. Linn. Soc.* 9: 423. 1867.
Crepidotus croceolamellatus Gill., *Champ. Fr. Hym.*, p. 557. 1878.
Tapinia panuoides Karst., *Hattsv.*, p. 452. 1879.
Paxillus acheruntius (Humb. ex) Schröter, *Jahresb. Schles. Ges. für* 1884, p. 300. 1885.
Paxillus lamellirugus Quél., *Enchir.*, p. 93. 1886.
Paxillus ionipus Quél., *Assoc. Fr. Avanc. Sci., Congrès d. Toulouse*, p. 588. 1887.
Tapinia lamellosa (Sow. ex) Murr., *N. Amer. Fl.* 10(3): 146. 1917.
Tapinella panuoides Gilbert, *Bolets*, p. 67. 1931.
? *Gomphus pezizoides* Pers., *Mycol. Europ.* 2: 10. 1825.
? *Cantharellus olivaceus* Schw., *Trans. Amer. Phil. Soc. ser. II.* 4: 296. 1832 (*sec. Murrill*).

Pileus dusky ochraceous to olive ochraceous, "cartridge buff," "cream buff," "chamois," "honey yellow," "Isabella color," "colonial buff," "deep colonial buff," sometimes the basal tomentum purplish-violet, the entire surface pubescent to more or less tomentose but usually glabrescent, sometimes rivulose, conchoid, or spathulate-substipitate, dimidiate or with a short, indistinct, concolorous, lateral stipe, 20–85–(100) mm. — *Hymenophore* concolorous or, especially when young and fresh, more yellow, reaching a color between "Naples yellow" and "mustard yellow," eventually more dirty tan, or "chamois" from the spore dust, easily separable from the context, lamellae decurrent or radiating from an eccentric point, rather narrow or narrow, crisp, anastomosing by veins, at least near the base of the pileus, and sometimes strongly anastomosing-lamellose and corrugate because of veins which transversely run down the sides of the lamellae, occasionally some forked without forming anastomoses, rather close to close; spore print "chamois." — *Context* cream color to whitish, soft, rather thin to thin, but sometimes gradually thickening to rather thick near the point of attachment; taste mild or very slightly bitterish; odor none, or not remarkable.

Spores 3.8–6 x 3–4.5 μ , mostly around 4.8 x 3.5 μ in America, 5.8 x 3.5 μ in Europe, melleous-pallid or pale melleous, smooth, thin-walled, ovoid-ellipsoid; *basidia* 19–26 x 4.5–6.2 μ ; *cystidia* and *cheilocystidia* none; *trama* of the lamellae bilateral, the mediostratum and the lateral stratum equally dense or the former denser, especially farther away from the edge, splitting along the mediostratum on increase of pressure; mediostratum composed of subparallel-subinterwoven hyphae in young stages and near

the edges, of more truly interwoven hyphae in age and near the ground of the lamellae, but always with a distinct axillar orientation; lateral stratum mainly directed obliquely toward the subhymenium but increasingly interwoven, irregular, and even intermixed with age because of the presence of broad, sometimes clavate hyphae near the subhymenium; *cilia* of the marginal tomentum of the pileus formed by 4–5 μ thick, long hyphae; *hyphae* with clamp connections.

Chemical reactions: **KOH** on the surface of the pileus, olive; on lamellae and context, olive to dull deep yellow; **NH₃**—vapors on the surface of the pileus, strongly lilaceous-drab, livid; **H₂SO₄** on the surface of the pileus, dull, deep yellow, little reaction elsewhere; **FeSO₄** on context slightly olive.

Habitat: On coniferous wood, on trunks and stumps in the forests as well as on structural wood in houses, on bridges, in mines, etc. where it is apt to develop fertile though mostly resupinate fruiting bodies in perfect darkness; preferring pine. Fruiting in summer to late fall if growing in the open in the northern states, elsewhere also found fruiting in winter and spring. Usually gregarious, frequently cespitose.

Distribution: Nearly a cosmopolite, but rarer or partly absent in the tropics. Known from North, Central and South America, Europe, Asia, Africa, and Australia. In Florida not common.

Material studied: **Fla.:** Alachua Co., Cary Forest, Nov. 1938, *Erdman West & W. A. Murrill*, det. Murrill, *F 17708* (FLAS). — **N. H.:** August 1860, *Blake*, det. Curtis 740 (FH). — **Mass.:** Harvard, on coniferous wood, July 1944, *Harrie Dadmun & R. Singer* (det. R. Singer) (FH); *Murray, Sprague* (581) (FH); type of *P. ligneus* B. & C. *Murray, Sprague* (1149) (FH); Floating Bridge, Lynn, August 1913, *E. B. Blackford* (FH); Arlington, Oct. 1907, *Piguet*, det. Farlow (FH). — **Conn.:** type of *P. hirtus* B. & C., *Wright* 234 (FH). — **N. Y.:** Enfield Gorge, Sept. 1903, *C. H. Kauffman* (FH). — **S. C.:** Santee Canal, *Ravenel* (1038) (FH). — **Ga.:** Northeast Ga. near Tallulah Falls, Tannery Brook, August 1901, *A. B. Seymour*, det. Farlow (FH). — **Tenn.:** Great Smoky Mts., Greenbrier, July 1939, *L. R. Hesler* (FH); Grassy Patch, July 1940, *A. J. Sharp*, det. L. R. Hesler (FH). — **Ala.:** "Alabama superioris" Dec. 1855, *Peters* (925) (FH). — **Ore.:** Wygant State Park, Hood River Co. Oct. 1937, *W. B. Cooke* (9675). — **Cal.:** Berkeley, February 1933 (FH). — **Mexico:** *Botteri*, det. Curtis (as *P. ligneus*) (2) (FH). — **Brazil:** São Leopoldo, 1932, *Rick* (FH). — **Sweden:** Upsala, 1853, *E. P. Fries* (FH). — **U.S.S.R.** (former Finland): Kellomäki, Sept. 1940, *R. Singer* 5–789 (LE).

The European plant usually has slightly larger spores, but this character is by no means constant. Excellent colored figures of this have been published, best of all is that in Lange, *Flor. Agar. Dan.* 4: pl. 134, fig. B. Elrod and Blanchard's photomicrograph (*Mycologia* 31: 697. fig. 1, D. 1939) of the gill trama gives an idea of the structure of a not quite young though not very old specimen, but few details are visible. Jossierand (*Bull. Soc. Myc. Fr.* 48(2):112. pl. 13, fig. 3. 1932) published a better figure, showing exactly what we have seen and described above.

EXTRALIMITAL SPECIES

Paxillus Curtisii Berk. *apud* Berk. & Curt., Ann. Mag. Nat. Hist. ser. II. 12: 423. 1853.

Paxillus corrugatus Atk., Stud. Amer. Fung., p. 170. 1900.

This species has smaller spores than *P. panuoides*, as is shown by examination of the type (on pine wood in Georgia), collected by Ravenel in September 1848, # 853, preserved at the Farlow Herbarium. In fact these spores are the smallest known in the Boletineae. Since this species occurs from New England to Georgia, it is possible that it will be discovered in north Florida.

Sect. **Involuti** Sing. sect. nov.

Pileo lateraliter vel excentrice vel subcentraliter stipitato; stipite glabro; sporis volumine mediocri gaudentibus; cystidiis praesentibus.

Characters of the section: see the key p. 539, and the above Latin diagnosis.

Paxillus involutus (Batsch *ex* Fr.) Fr. Epicrisis, p. 317. 1838.

This common and widely distributed species is remarkable for its absence in Florida. It occurs in Uruguay where it has been collected by Herter, determined as *Paxillus argentinus*, which strongly differs in having a veil. The trama of these specimens is divided into an intermixed-interwoven hymenopodium, and a subregular mediostratum or rather trama proper, consisting of brownish, 3.5–9 μ broad hyphae, while in the hymenopodium the hyphae are hyaline to brownish and still more variable in diameter; all hyphae with clamp connections; spores 8–11.5–(13) \times 5–7.5 μ , the wall occasionally up to 1 μ thick; basidia 4-spored, about 31 \times 7.8–9.8 μ ; cystidia hyaline to brownish, versiform, 34–65 \times 13–20 μ ; hyphae of the cuticular layer of the pileus repent, long-cylindric. For the chemical reactions of European specimens, see Ann. Myc. 40: 58. 1942.

SPECIES EXCLUDENDAE

Paxillus miniatus Rick, Broteria 5: 19. 1906.

The type of this species does not exist in Brazil; authentic material kindly sent by J. Rick does not fit in the original diagnosis, and is a species of the Lentineae with smooth, hyaline spores. We therefore consider *P. miniatus* as a dubious species, and propose *P. russuloides* Petch as the type species of the genus *Phyllobolites* Sing. *P. lateritius* is also thought to belong in *Phyllobolites*.

Paxillus pubescens Ellis, see under *Gomphidius rutilus* ssp. *alabamensis*.

Paxillus pinguis Hook. fil. *apud* Berk., Hook. Journ. Bot. 3: 41. 1851.

This is, as is shown by the unpublished colored figure of Hooker (FH), one of the subspecies of *Phylloporus rhodoxanthus*, and so are certainly *Paxillus flavidus* Berk., Lond. Journ. Bot. **6**: 315. 1847, *Paxillus rhodoxanthus* (Schw.) Ricken, Blätterpilze. **1**: 95. 1911, *Paxillus Tammii* Pat., Tab. Anal. **4**: 161. 1885, *Paxillus Pelletieri* (Lév.) Velen., Česk. Houb., p. 356. 1920, and *Paxillus paradoxus* (Kalchbr.) Cooke, Grevillea **5**: 6. 1876. *Paxillus sulphureus* Berk. is most probably another species of *Phylloporus*.

Paxillus prunulus (Scop. ex Fr.) Quél., Enchir., p. 92. 1886.

See *Clitopilus prunulus* Jugasporaceae, p. 551 of this paper.

Paxillus reniformis Berk. & Rav. *apud* Berk. & Curt., Ann. Mag. Nat. Hist. ser. II. **12**: 424. 1853.

This species described from North Carolina has been compared with *Paxillus panuoides* by Murrill, N. Amer. Fl. **10**(3): 146. 1917. However, the type (FH) has verrucosely punctate spores of 8.3–10.2 x 5.5–6.5 μ , and all the main characters of a *Crepidotus*. The combination **Crepidotus reniformis** (B. & R.) Sing. comb. nov. is proposed. *C. versutus* Peck is probably the same species.

Hygrophoropsis R. Maire *apud* Martin-Sans, L'Empoisonnement, p. 99. 1929.

Cantharellus subgen. *Hygrophoropsis* Schröter in Cohn, Krypt. Fl. Schles. **3**(1): 511. 1889.

Merulius S.F. Gray, Nat. Arr. Brit. Pl. **1**: 636. 1821 (*non* Fries).

Characters of the genus: see key, p. 539. Type species, *Hygrophoropsis aurantiaca* (Wulf. ex Fr.) Maire *apud* Martin-Sans [*Cantharellus aurantiacus* (Wulf.) ex Fr.]

The species entering this genus were formerly considered to belong in *Cantharellus*, but since they are fundamentally different in many regards from the type species of that genus, they were transferred by Studer, Maire, and others to *Clitocybe*. The writer formerly agreed with this point of view though *Hygrophoropsis* did not show close relationship with any group of *Clitocybe*. It appears that the characters in common with *Paxillus* are much more striking than the ones that suggested the comparison of *Hygrophoropsis* with *Clitocybe*. The soft context is typical for the Boletineae, and the tramal structure is strongly reminiscent of *Paxillus* and *Clitopilus*. The small, slightly yellowish spores are similar to these of *Paxillus panuoides*. The discovery of a second species, *H. tapinia*, with smaller spores and an external appearance frankly suggesting *Paxillus Curtisii* but never met with in *Clitocybe*, makes the affinity between *Hygrophoropsis* and *Paxillus* an established fact.

4. **Hygrophoropsis tapinia** Sing. spec. nov.

Pileo pallide aurantiaco, admodum excentrico vel astipitato, tomentoso, infundibuliformi-irregulari, carnosio atque tenui, usque ad 35 mm. lato; lamellis aurantiacis,

immutabilibus, furcatis, haud anastomosantibus nec corrugatis, acie obtusa instructis, angustis, descendentibus vel arcuate distincte profundeque decurrentibus; sporis in cumulo albidis, sub microscopio hyalinis vel pallide luteolis, $3.3-4.8 \times 2.5-3.3 \mu$; basidiis $16-20 \times 3.7-6.8 \mu$; cystidiis nullis; hyphis fibuligeris; stipite pumilo vel nullo, concolori; carne pallidior, immutabili, molli, inodora. Habitatio: In truncis cavis, ad sarmenta in dumetis, etc., Septembri et Octobri mensibus, Florida, U.S.A.

Pileus "pale orange yellow," very eccentric to astipitate, tomentose, infundibuliform or irregular, fleshy but rather thin, up to 35 mm. broad. — *Hymenophore* "capucine orange," becoming brownish orange, unchanging on drying and on injury, strongly forking but not anastomosing nor corrugate, smooth with blunt edges, narrow, decurrent; spore print white or whitish on white paper in thin layer. — *Stipe* small, concolorous, or wanting. — *Context* paler than the surface, unchanging, soft, inodorous.

Spores hyaline to pale yellow under the microscope, $3.3-4.8 \times 2.5-3.3 \mu$; *basidia* mostly 4-spored, $16-20 \times 3.7-6.8 \mu$; *sterile bodies* in the hymenium not infrequent (aborted basidia?), extremely variable in shape, usually numerous on edge; typical *cystidia* absent; *trama* consisting of hyaline, thick (0.7μ) or thin-walled, often slightly gelatinized hyphae, bilateral with more parallel-subinterwoven hyphae in the axillary arranged mediostrium (respectively trama proper), and with more irregularly arranged but mostly straight hyphae in the accompanying layers (lateral stratum or hymenopodium); *clamp connections* numerous.

Habitat: On dead trunks of frondose trees and on sawdust in dense hammocks, never under or on conifers. September and October.

Distribution: South Florida.

Material studied: Fla.: Dade Co., Simpson Park, Miami, on sawdust in dense tropical hammock vegetation, October 1942, R. Singer F 1037 (FH); Brickell's Hammock, Miami, on a dead trunk in tropical hammock, October 1942, R. Singer, F 1273 (FH).

This species is very close to *Hygrophoropsis aurantiaca* from which it is distinguished mainly by the smaller spores and the habit of fruiting which suggest *Paxillus Curtisii*. The description of a British species, *Paxillus Fagi*, may suggest to some our Florida species, but it is too poorly characterized and moreover the surface is said to be pallid. *Paxillus aurantiacus* Ellis probably belongs in this group but it reminds one rather of *Hygrophoropsis aurantiaca* than of *H. tapinia*.

5. *Hygrophoropsis aurantiaca* (Wulfen ex Fr.) R. Maire apud Martin-Sans, L'Empoisonnement p. 99. 1929.

Cantharellus aurantiacus Fr., Syst. Myc. 1: 318. 1821.

Merulius aurantiacus Persoon ex S. F. Gray, Nat. Arr. Brit. Pl. 1: 636. 1821.

Cantharellus Ravenelii Berk. & Curt., Ann. Mag. Nat. Hist. ser. II. 12: 425. 1853.

Clitocybe aurantiaca Studer, Beiblatt z. Hedwigia 39:(7). 1900.

Chanterel alectorolophoides (Schaeff. ex) Murrill, N. Amer. Flora 9(3): 169. 1910.

Var. *typica*

The type variety is a common species in the northern states of this country, in Canada, in Europe, especially in the northern and central part of that continent, and in Asia. I have collected typical specimens in all these regions but not farther south than the Caucasus Mts. in Asia. D. H. Linder has collected good specimens in Virginia, U.S.A., as did L. R. Hesler in Tennessee, and Ravenel collected the type of *Cantharellus Ravenelii* B. & C. in South Carolina. This is definitely the most southerly place where this species has been found in this hemisphere. The type is in rather good condition, and appears to belong here, as suggested by Murrill. The spores of the type variety are $4.8-8 \times 2.7-4.8 \mu$, ellipsoid to cylindric or rarely reniform, thin-walled, or somewhat thick-walled, hyaline to slightly yellowish-hyaline; basidia $19-40 \times 5-9.5 \mu$; cystidia none, or rare, but sometimes some aborted basidia present; the trama consists of a mediostratum (trama proper) with distinctly subparallel-interwoven thicker-walled hyphae which are more loosely arranged than in the hymenopodium; the latter strongly irregular, the hyphae running in all directions, many of them obliquely toward the subhymenium; the hyphae making up the hymenopodium are denser and slightly thinner and also have somewhat thinner walls than the hyphae of the mediostratum; the latter is distinctly continued above the dorsal end of the lamellae just below the context of the pileus as can be observed in most Boletineae. Paler to partially white carpophores are not infrequently observed in northern Europe, and have been described under various varietal names. For a complete description of this species, see Ann. Myc. **41**: 22. 1943, under *Clitocybe aurantiaca*. The type variety has not been observed as far south as Florida. We have observed only a single specimen of what we think is a dwarf form or a smaller race of this species since it is regularly stipitate and has the spores of the general measurements of this species. However, it was found on frondose trunk in low hammock, far from any conifers and this makes it more remarkable.

Var. **nana** Sing. var. nov.

Carpophoris minusculis, gracillimis et habitatione in truncis cavis arborum frondosarum in silva palustri subtropicali a typo differt.

Pileus brown, velutinous-tomentose, dry, convex, 6 mm. broad; margin smooth, initially involute. — *Lamellae* reddish orange, orange, narrow, forked, subobtusate at the edge, decidedly decurrent, descendant or arcuate, rather close; spore print not obtained. — *Stipe* dirty orange brownish, subvelutinous, solid, subequal, soft, 9×1 mm. — *Context* subconcolorous with the surfaces, soft, mild to the taste, inodorous.

Spores hyaline, $6-8 \times 3.5-3.7 \mu$, ellipsoid to subcylindric, smooth, non-amyloid; *basidia* $20-30 \times 5-7.7 \mu$; *cystidia* none seen; *trama* as described in the type; *tomentum of the pileus* consisting of loosely interwoven hyphae, some of them slightly rough (from gelatinous matter), filamentous-cylindric, hyaline, $3-7 \mu$ in diameter; all *hyphae* with clamp connections.

Chemical reactions: KOH, NH_4OH , and FeSO_4 : little reaction.

Habitat: In the hollow trunk of living *Nyssa sylvatica*, in low hammock vegetation, far from conifers. Solitary in summer.

Distribution: Known only from the type locality.

Material studied: Fla.: Highlands Co., Highlands Hammock State Park, Sept. 1942. R. Singer, F 640, **type** (FH).

SPECIES INCERTAE SEDIS

Hygrophoropsis albida (Fr.) R. Maire, Publ. Inst. Botàn. 3(4): 58. 1937.

Cantharellus albidus Fr., Syst. Mycol. 1: 319. 1821.

This species has been described from Sweden. I have a few times collected specimens which I used to attribute to it, but since I have not recently restudied any of these, I hesitate to refer them here, for the available dried material is not well enough preserved to allow more detailed anatomical studies. *Cantharellus albidus* (*Hygrophoropsis albida*) does not occur in Florida. Maire thinks it belongs in this genus. He lists it in the family Leptotaceae, but the type genus of that family, *Leptotus*, belongs in the Cyphellineae, and has nothing in common with *Hygrophoropsis*, as a special study of the Leptotaceae showed (see R. Singer, The *Laschia*-complex. Lloydia 8: 188. 1945.)

JUGASPORACEAE (Kühner *ut trib.*) Sing. (1936)

Characters of the family: pileus subglabrous to sericeous, smooth or more rarely venose, not viscid or scarcely viscid, small or rather large, the margin initially frequently involute, the color as in the whole carpophore usually pallid, white, more rarely light gray; hymenophore lamellose, lamellae decurrent if there is a stipe; spore print pink; context with more or less distinct farinaceous odor, more rarely subinodorous; stipe central eccentric, lateral or absent; veil none; spores hyaline to pale stramineous under the microscope, with 5–10 longitudinal ridges or veins or blunt angles formed by flattened stripes running from the hilar end to the apex, without germinative pore, thin-walled, the wall easily collapsing and the folds thus formed sometimes resembling additional ridges, young spores more smooth and rounded, ovoid, ellipsoid, fusoid, asymmetrical; cystidia none; hyphae of the cuticle and the surface of the stipe (if present) repent; trama consisting of a mediostratum of interwoven to subirregular hyphae with a generally axillar arrangement, and becoming more parallel-regular when seen at a point closer to the edge, conspicuously intermixed near the ground (dorsal part) of the lamellae, looser in the mediostratum, and the hyphae thicker than in the lateral stratum (hymenopodium) where some hyphae run obliquely toward the hymenium. The hyphae generally are irregularly interlaced, and in neither the mediostratum nor the lateral stratum are they as loosely arranged as in *Boletus*. The species are homothallic (*sec.* Kühner & Vandendries). All hyphae are without clamp connections.

Habitat: On the soil and on various organic material, wood, dung, dead Cormophyta, etc.

The Jugasporaceae form a very natural family. They have important characters in common with the Paxillaceae: the general appearance and biology, the shape and size of the spores, the structure of the trama (though the bilateral character of the latter is still less evident in the Jugasporaceae than it is in the Paxillaceae), the soft context, the occurrence of poroid hymenophores in aborted carpophores, the absence of cystidia (if *Paxillus involutus* is exempted), and the initially involute margin. On the other hand, it cannot be denied that there is a slight analogy with the Rhodogoniosporaceae, in the color of the spores in prints, the odor, and the frequent occurrence of pigmentless species. It is a fact that the sessile as well as the smaller stipitate forms of *Rhodophyllus* and *Clitopilus* are hard to distinguish if one has to rely on macroscopical characters only. It is just as true that some *Rhodophylli* with very rounded angles on the spores are equally hard to distinguish from the Tricholomataceae, such as *Rhodocybe* (cf. Lloydia 5(2): 110. 1942). Lange relates *Clitopilus prunulus* to the Paxilli by putting it in a neighboring genus *Paxillopsis* Lange, but this latter genus is complex, containing all kinds of atypical Paxilli, including even *Rhodopaxillus*. Ricken, following Quélet, made *Clitopilus* a straight synonym of *Paxillus*, but his generic conception of *Paxillus* was still very broad, evidently under the influence of Quélet and Fries. Lundell, in *Fungi Exsiccati Suecici* #137 says: "Modern authors have placed it in the genus *Paxillus*. Lange justly eliminates *Clitopilus* altogether, and placed the smooth-spored species with *Paxillus*, and the angular-spored ones with *Eccilia*." Since Lundell understands *Paxillus* in a somewhat restricted sense, probably in approximately the same way as we do, his classification of *Clitopilus prunulus* within a restricted genus *Paxillus* goes much farther than I would go considering the differences between *Clitopilus* and *Paxillus*, especially in the spore color and clamp connections. Fayod (1889) comes closest to the point of view expressed in my papers since 1936. He has the following arrangement: Series D: Tribe 25 Goniosporés (the genera now considered as *Rhodophyllus*); Tribe 26 Paxillés (the genera here combined in the genus *Paxillus* and the genus *Gomphidius*); Tribe 27 Fusiosporés (the genera here combined in *Clitopilus*). Fayod also admits the affinity of the Paxillés with certain boletes, but so did Opatowski in 1836.

The position of the Jugasporaceae in the classification of the Agaricales is one of the most difficult problems in spite of the large number of facts now available. If the similarity with the Rhodogoniosporaceae and *Rhodocybe* (in the first case the external similarity, in the latter case the similarity of the spores⁴) is considered to show affinity, we arrive at the

⁴ The spores of *Rhodocybe alutacea* Sing. *ined.*, a species closely related to **R. truncata** (Fr.) Sing. comb. nov. ssp. *subvermicularis* (Maire) Sing. (*Rhodopaxillus truncatus* (Fr.) Maire var. *subvermicularis* Maire from North Africa, are at the same time warty because of thickenings of the wall, and when seen from above, obtusely applanate forming a hexagon. This latter character reminds one strongly of *Clitopilus*,

alternative solutions of this problem: either the Jugasporaceae are at the same time related with the Rhodogoniosporaceae (*Rhodophyllus*, *Rhodocybe*) on one hand, and the Paxillaceae on the other hand, or the Rhodogoniosporaceae and *Rhodocybe* would better be added to the Boletineae in the larger sense, or the Jugasporaceae could be combined with the family Rhodogoniosporaceae (*Rhodophyllus*, *Rhodocybe*). In view of the strong arguments in favor of an affinity with the Paxillaceae, and the plurality of possibilities suggested by the similarities with the Rhodogoniosporaceae and *Rhodocybe*, we think it best to leave the Jugasporaceae within the Boletineae at present, and wait for new facts to be found that might throw more light on the presumed affinity with other pink-spored agarics. It may well be that this affinity is not more than a certain coincidental similarity in spore shape.

Since the type concept, now obligatory in nomenclature, excludes the elimination of *Clitopilus*, and also its reestablishment in a modified sense as formerly advocated by R. Heim and myself, I cannot but follow the example of Konrad and Maublanc, R. Maire, Jossierand, and others who use the genus *Clitopilus* in the way it is used in the present paper. The question of whether the smaller species should be kept in a separate genus (*Octojuga* Fay.), or combined with *Clitopilus*, is, as I have emphasized on several occasions, a question of the definition of the word genus. As it seemed before the entrance of certain intermediate species into the taxonomic picture of this family, the larger and the smaller species were well separated by several correlated characters, i.e. the striation and the size of the spores, the general appearance, and the habitat. Since then, however, it has turned out that minute species like *Omphalia Giovanellae* Bres. (see *Mycologia* 34: 66. 1942) and *Omphalia scyphoides* Fr. belong here, species with central or eccentric stipe like *Clitopilus prunulus*, and also growing on the soil. The difference in the spores does not seem to be so important now since I have studied many species and specimens, and find that only the length of the spores is consistently though slightly different in the two groups. Two Indo-Chinese species, one of them (*C. crispus*) very similar to *C. prunulus*, have strongly 8–10-ribbed spores instead of 6-ribbed ones, and besides the spores are shorter than in *C. prunulus*. I therefore do not think that the differences as they appear now are sufficient for the establishment of two genera within the family Jugasporaceae, and, like Jossierand (*Bull. Soc. Myc. Fr.* 53: 209–213. 1937), I admit (*l.c.*) only one genus *Clitopilus*.

The longitudinal striation of the spores of the Jugasporaceae cannot be identified with the ridges of the spores in *Boletellus*. In the latter case, the optical section through the short axis of the spore shows terete spores with

and as a matter of fact, Kühner has recently stated that in his opinion *Clitopilus prunulus* is related to certain species of *Rhodopaxillus* as he calls the clampless species which we refer to *Rhodocybe* in spite of the lack of pseudocystidia, e.g. *Rhodocybe fallax* (Quél.) Sing. Syn: *Rhodopaxillus fallax* (Quél.) R. Maire. See *Bull. Soc. Linn. Lyon*, Sept. et Oct. 1945, no. 7–8.

the veins or lamellose ridges projecting like thorns or wings, while in the Jugasporaceae we have a regular hexagon (with the angles slightly protracted or mucronate in *Clitopilus prunulus*) or heptagon, octagon, etc. In the latter case, the angles often are so obtuse that the striation of the spores is extremely difficult to observe, and only the outline of an optical section with the longer axis vertically directed towards the objective reveals the character of the spore. This character may also be obscured by the fact that young spores are more round in this position, and some do not seem ever to reach the striate stage. This is the case with *Clitopilus scyphoides*, and, to a lesser degree, *C. Passeckerianus*. But even then the color of the spore print should easily exclude the genus *Omphalia*, and the lack of clamp connections should exclude *Clitocybe*, *Dochmiopus*, etc.

Clitopilus (Fr.) Quél., Champ. Jura p. 120. 1872, *sensu* Patouillard, Hym. Eur., p. 113. 1887.

Agaricus trib. *Mouceron* Fr., Syst. Myc. 1: 193. 1821.

Agaricus trib. *Clitopilus* Fr., Epicrisis, p. 148. 1836, *non* Syst. Mycol.

Hexajuga Fayod, Ann. Sci. Nat., sér. VII. 9: 389. 1889.

Octojuga Fayod, Ann. Sci. Nat., sér. VII. 9: 390. 1889.

Characters of the genus: they are the same as for the family. The type species is *Clitopilus prunulus* (Scop. ex Fr.) Quél. (*Agaricus prunulus* Fr.)

KEY TO THE SECTIONS AND SPECIES KNOWN TO THE AUTHOR

- A. Carpophore medium to rather large, pileus 30–130 mm. broad, fleshy, with the external appearance of a larger *Clitocybe*, or *Paxillus involutus*; spores with 6 longitudinal furrows between 6 longitudinal folds or ridges, and therefore three-striate when seen in profile, (7)–10–14 μ long: growing on the soil.

Sect. *Prunuli*

6. *Clitopilus prunulus*

- A. Carpophore smaller than indicated above, or spores smaller; spores either ridged as above, or seemingly smooth but appearing polygonal when seen from one end (with the longer diameter vertically directed toward the objective), 5.5–11.5 μ long, ridges or angles variable in number, usually more than 6, often up to 10; growing on the soil (mostly sand), or on various debris, rotting or rotten wood, manure, etc.

- B. Stipe present, constantly persistent.

Sect. *Scyphoides*

- C. On horse manure in mushroom cellars; stipe very small, less than 3 mm. long.

Clitopilus Passeckerianus

- C. Not on manure, only in the open; stipe usually larger.

- D. Pileus gray.

7. *Clitopilus Giovanellae*

- D. Pileus white.

- E. Spores with scarcely projecting ridges or folds, merely angular when seen from one end.

8. *Clitopilus scyphoides*

- E. Spores with strongly (0.3–0.4 μ) projecting longitudinal ridges or folds.

- F. Pileus fleshy with crenate margin. *Clitopilus crispus*

- F. Pileus thin with smooth, entire margin.

Clitopilus orcelloides

B. Stipe absent, or spurious, or disappearing with age, or inconstant.

Sect. *Pleurotelloides*

G. On horse manure, in white-mushroom cellars. (Rare astipitate form of *Clitopilus Passeckerianus*)

G. On substrata other than manure.

H. Pileus rugose-venose; growing on the wood of evergreen trees in tropical hammock. 9. *Clitopilus venososulcatus*

H. Pileus smooth, or transparently striate. 10. *Clitopilus pleurotelloides*

Sect. **Prunuli** (Quél. ut sectio subgeneris *Orcellae* generis *Paxilli*, Ench., p. 92, 1886) *em.*

Carpophoris mediocribus vel majusculis, carnosis, distincte stipitatis; sporis 6 rugis longitudinalibus instructis, 10–14 μ longis. Ad terram.

Characters of the section: they are evident from the key and the Latin diagnosis above. Type species as in the genus *Clitopilus*.

6. ***Clitopilus prunulus*** (Scop. ex Fr.) Quél., Champ. Jura, p. 120. 1872.

Agaricus prunulus Scop. ex Fr., Syst. Mycol. 1: 193. 1821.

Agaricus orcellus Bull. ex Fr., Syst. Mycol. 1: 180. 1821.

Clitopilus orcellus Quél., Champ. Jura, p. 120. 1872.

Paxillus prunulus Quél., Enchir., p. 92. 1886.

Paxillus prunulus var. *orcella* Quél., Enchir., p. 92. 1886.

Hexajuga prunulus Fayod, Ann. Sci. Nat., sér. VII. 9: 289. 1889.

Rhodosporus prunulus Schröter, in Cohn, Krypt.-Fl. Schles. 3(1): 618. 1889.

Pleuropus prunulus Murr. N. Amer. Fl. 10(2): 104. 1917.

Pleuropus obesus Murr., N. Amer. Fl. 10(2): 105. 1917.

Paxillopsis prunulus Lange, Flora Agar. Dan. 4: 48. 1939.

Pileus whitish, whitish-gray, whitish-cream, sometimes with spots, dots, or zones, sometimes scarcely subviscid during rains, but usually quite dry, mostly finely velutinous or innately mealy, convex but very soon flatter and depressed though usually very irregular, with involute, eventually irregularly-lobed margin, and obtuse, rarely indistinctly umbonate disc, smooth, 30–130 mm. broad. — *Hymenophore* white or whitish, then pale incarnate, easily separable from the context of the pileus, lamellae frequently not straight, moderately close to close, rather narrow or narrow (up to 4 mm. broad), deeply decurrent; spore print "fawn color." — *Stipe* white or concolorous with the pileus, slightly fibrillose striate, glabrous or subglabrous, often with tomentose base, naked, versiform, solid, but softer inside, 26–50 x 6–21 mm. — *Context* white, soft, with the consistency of a bolete; taste mild, farinaceous; odor strong, farinaceous (of fresh flour, or flowers of *Berberis vulgaris*).

Spores elongate-ovoid to mostly subfusoid, with distinct suprahilar depression, with (5)–6–(7) longitudinal brims or edges which usually are more or less projecting, forming low ridges or folds with furrows running between them, the angular outline well-marked in an optical section with the long diameter of the spore vertically directed towards the objective (use chloral hydrate as medium), hyaline to hyaline-stramineous, asyn-

metric, (7)–10–14 x 5–6 μ , most frequently 10.5–12 x 5–5.8 μ ; *basidia* 4-spored, 30–36 x 8.3–9.8 μ ; *cystidia* and *cheilocystidia* none; *trama* of the lamellae intermixed-subbilateral, the mediostratum differing from the lateral stratum respectively the hymenopodium⁵ in consisting of large, irregularly arranged elements in the basal (dorsal) portion of the lamellae, and generally in being less densely interlaced, and much thicker; toward the edge of the lamellae these differences become less distinct, the mediostratum becoming more regular and its elements more elongate and narrow, and even the hymenopodium becoming slightly less interlaced, its hyphae showing a slight but indistinct tendency to diverge toward the hymenium, 5.5–6 μ in diameter; hyphae of the *cuticular* layer of the pileus repent, cylindric-filamentous; all *hyphae* consistently without clamp connections.

Chemical reactions: **NH₄OH**, yellowish-brown-vitreous. — **FeSO₄**, no reaction. — **Guaiacol** reacting only in the base of the stipe, and even there weakly and slowly. — **Methylparamidophenol**, negative to weak, or moderate reaction in stipe, no reaction or only a weak one on the pileus, the edges of the lamellae usually becoming distinctly deep umbrinous, in young specimens the surface of the pileus and the edges of the lamellae becoming distinctly deep violet but the rest of the carpophore remaining negative.

Habitat: In open woods and gardens, in meadows near isolated trees of all kinds, always on the soil, on sandy earth as well as on limestone; fruiting from May to November, usually in small groups.

Distribution: Europe, Caucasus, North Africa, North America south to Florida. In Florida known only from well-watered lawns in north Florida.

Material studied: **Fla.:** Alachua Co. Gainesville, some collections by *W. A. Murrill* (*Pleuropus obesus*) (FLAS); by *R. Singer* *F 1867*, *F 1867a* (FH). — **N. H.:** Chocorua, August 1904, *Farlow* (FH). — **Mass.:** Canton, August 1925, *D. H. Linder* (*C. orcellus*) (FH); Wakefield, August 1943, *R. Singer* (FH). — **N. Y.:** Newcomb Co., Mt. Goode-nov, September 1941, *R. Singer* (FH). — **Ia.:** Iowa City, September 1936, *G. W. Martin* (FH). — **Tenn.:** Highlands, August 1936, *L. R. Hesler* & *A. J. Sharp* (FH). — **Canada:** **N. B.:** October 1903, *det. Farlow* (FH). — **U.S.S.R.:** Moscow region, *Mikhailowskoe*, June 1896, *Buchholz* (FH); Leningrad region, near *Ryabovo*, August 1938, *R. Singer* (*Hexajuga prunulus*) (LE). — **Spain:** Catalonia, *Salardú*, June to October 1934, *R. Singer* (BA). — Numerous collections of the fresh fungus in Czechoslovakia, Austria, Bavaria, and France, and abundant dried material from all European countries in the European herbaria. — Asiatic part of the **U.S.S.R.**, Caucasus, *Abkhazia*, *Saken*, August 1928, *R. Singer*; Caucasus, *Guzeripl*, August 1935, *L. N. Vassilieva* (KAZ).

This is an easily identified species, and one of the less-known but excellent edible mushrooms. *Clitopilus orcellus* is only an insignificant form of this species. Its occurrence in Gainesville, south of the 30th parallel, probably marks the southernmost limit of the species.

⁵ What I call the hymenopodium, has been described by others as the subhymenium, e.g. by *R. Maire* for *Clitopilus cretaceus* *Mre.* (See also p. 538 and 547 of this paper.)

Sect. **Scyphoides** Sing. sect. nov.

Carpophoris vix mediocribus, aut sporis minoribus quam $10\ \mu$ et tunc carpophoris nonnunquam mediocribus vel submajusculis, constanter distincte stipitatis.

Characters of the section: compare the key p. 550, and the above Latin diagnosis. The type species is *Clitopilus scyphoides* (Fr.) Sing., more exactly var. *typicus* fa. *typicus*, as defined below, p. 554.

7. **Clitopilus Giovanellae** (Bres.) Sing., Mycologia 34: 66. 1942.

Omphalia Giovanellae Bres., Fung. Trid. 1: 9, pl. 5, fig. 2. 1881.

Pileus gray, sometimes somewhat shining, sericeous, smooth, but often subrugulose on the margin, and also slightly transparently striate at the extreme margin when wet and quite mature, not viscid, convex with a deep umbilicus in the center from the beginning, eventually becoming flatter to infundibuliform, 6–8 mm. broad (5–14 mm. according to Bresadola). — *Hymenophore* pale gray, easy to separate from the context of the pileus, lamellae very thin and slender, deep decurrent, arcuate, subclose to close, narrow; spore print pinkish. — *Stipe* grayish-white to gray, somewhat silky, central, or sometimes somewhat eccentric, subequal, very thinly and finely velutinous toward the base in many specimens, but in our Florida material never seen with white tomentum at the base, as described by Bresadola, solid or stuffed, 5–12 x 1–1.5 mm. — *Context* pallid, very brittle when dried, tender when fresh; *odor* very slightly farinaceous, almost inodorous in most cases; *taste* distinctly farinaceous but not bitter.

Spores 6–7 x 3.5–4 μ , smooth, with eight or less longitudinal flattenings bordered by obtuse or almost rounded edges, not or hardly visible even in chloral hydrate but the outline of an optical section clearly octagonal (or hepta- or hexagonal) when the longer diameter of the spore is pointing up toward the objective (like an egg seen "from above"), fusoid to ovoid, hyaline to stramineous-hyaline, at least the larger spores with a supra-hilar depression, non-amyloid; *basidia* 16–25 x 6.8–8.3 μ ; *cystidia* and *cheilocystidia* none; *gill trama* partly intermixed; all *hyphae* without clamp connections.

Habitat: Widely scattered on sandy places, in May and June (June and July in Italy).

Distribution: With certainty known only from Italy and north Florida, probably widely distributed but easily overlooked since it is rare and small, and often occurs in places where commonly no fungi are expected.

Material studied: Fla.: Alachua Co., Gainesville, June 1943, R. Singer, F 2294 (FH); May 1943, W. A. Murrill, det. R. Singer, F 2072 (FH). — Italy: authentic, from Gocciadoro, province of Trento, July 1899, G. Bresadola (NY).

Among the smaller species of *Clitopilus*, sect. *Scyphoides*, this species is well-determined by its color and the more or less central stipe, its occurrence on sunny, sandy places in spring. There is a minor difference between our Florida material and the Italian plant, i.e. the lack of the white tomen-

tum on the base of the stipe of the former. This is an interesting parallelism to what we have observed in the following species, *C. scyphoides*. In neither case should too much importance be attributed to this frequently variable character. Otherwise, our specimens agree perfectly with the authentic material cited above. *C. Giovanellae* is new for this continent.

8. ***Clitopilus scyphoides*** (Fr.) Sing. comb. nov. (*sensu lato*).

Agaricus scyphoides Fr., Syst. Mycol. 1: 163. 1821 (equals var. *typicus* f. *typicus*).

Agaricus mutilus Fr., Syst. Mycol. 1: 191. 1821 (equals var. *typicus* f. *mutilus*).

Omphalia scyphoides Quél., Champ. Jura, p. 99. 1872.

Pleurotus mutilus Gill., Champ. Fr. Hymen., p. 344. 1878.

Omphalina scyphoides Quél., Enchir., p. 42. 1886.

Clitopilus submicropus Rick, Broteria, 6: 77. 1907 (equals var. *submicropus*).

Omphalina floridana Murr., Mycologia 33: 440. 1941 (equals var. *floridanus*).

Pleuropus minimus Murr., Lloydia 5: 144. 1942 (equals var. *floridanus*).

Clitopilus omphaliformis Joss., Bull. Mens. Soc. Linn. Lyon 10. 1941 (*fide* Locquin, *ibid.* 13: 107. 1944).

Var. ***typicus*** forma ***typicus***

The European type of this species does not occur in Florida, but it is here redescribed for comparison with the American varieties. Pileus white, convex and umbilicate or infundibuliform from the beginning, not hygrophanous or subhygrophanous but with a dry, sericeous, very thin and sometimes indistinct sericeous covering, eventually undulate but with more or less regularly circular outline, 5–25 mm. broad. Hymenophore white to creamy white, eventually pallid to pinkish in fertile specimens, separable from the context of the pileus, lamellae narrow (up to 1.5 mm. broad), arcuate or horizontal-linear, or descendant, always decidedly and mostly deeply decurrent, subclose to crowded. Stipe white, slightly sericellous, typically short, 4–10 x 0.5–1.8 mm. (up to 2 mm. at the typically white tomentose, frequently thickened base), equal or subequal, flexuous or straight (typically more frequently flexuous), solid or stuffed, becoming hollow in age. Context white, thin; odor farinaceous or none; taste farinaceous and mild. Spores ellipsoid-oblong, or in smaller spores with a rhomboid outline, typically narrower than in var. *floridanus*, 7.5–11.5 x 4–5.5 μ , otherwise as in the variety; basidia mostly 4-spored, 17–28 x 6.5–8.5 μ ; cystidia and cheilocystidia none; trama as in var. *floridanus*; cuticle of appressed, long, cylindric, smooth, claspless, 2.5–3.5 μ thick hyphae, making up the sericellous covering; neither the spores nor the hyphae are amyloid.

Habitat: Solitary or in small to large groups in moist or mossy meadows or fields, but also on the soil or on very decayed stumps in the woods, May to October, through most of Europe but I have never verified the indications from Siberia and South Africa. I have, however, made fresh collections in Bavaria, near Munich, where it is frequent in May and June on meadows, and I have examined the material in Lundell & Nannfeldt, Fungi Exsiccati Suecici (LE) as well as two specimens from the

Höhnelt Herbarium (FH), one from Jenbach, *V. Höhnelt B.2145*, one from near Trento, *F. v. Höhnelt*.

Var. **typicus** f. **mutilus** (Fr. *l.c.*) Sing. comb. nov.

Clitopilus omphaliiformis f. *calathinoides* Locquin, Bull. Mens. Soc. Linn. Lyon 13: 107. 1944.

This form does not occur in Florida, but it is here redescribed for comparison with other forms and varieties, and because it has so often been misinterpreted. *Pileus* white, subhygrophanous, very slightly transparently striatulate when wet, not viscid, very minutely subfarinaceous-subsericellous, not circular but elongate in outline when old, often becoming lobate, tongue-shaped, or labiate-depressed, very eccentric to lateral, and in the latter case assuming the general appearance of *Arrhenia auriscalpium* (but larger), with initially incurved margin, 10–14 mm. broad. *Hymenophore* white, eventually somewhat pink, lamellae crisp, with rather obtuse edge when young, forked or simple, rather narrow, subrounded-attenuate or arcuate to the stipe, descendant-decurrent, close. *Stipe* white, solid, short white tomentose at the base, erect and straight, occasionally flexuous, very minutely mealy-sericellous, subequal, 5–17 x 1–1.5 mm. *Context* white, fragile, inodorous. *Spores* 6.8–8.5 x 3.5–5 μ as in the var. *floridanus*; *basidia* up to 26.5 x 5–8 μ , 4-spored; *cystidia* and *cheilocystidia* none; *trama* intermixed, its bilaterality has not been checked by the author; hyphae without clamp-connections.

Habitat: On mossy north border of a mixed (*Pinus*, *Picea*, *Betula*) wood, growing among mosses (or actually on decayed needles scattered among these?).

Distribution: Certainly in Scandinavia, France, Finland, and also in the Leningrad region of the U.S.S.R., near Mga, August 21, 1938, *R. Singer & L. N. Vassilieva L37, 5–596* (LE). The above description was gathered from this latter collection. This form probably occurs in most of Europe.

Var. **floridanus** (Murr. *l.c.*) Sing.

PLATE I, FIG. 8–11.

Pileus white, pure white when dry, becoming sordid-pallid when old and wet, innately fibrillose-sericellous, smooth, or scarcely noticeably striatulate when wet, sometimes somewhat uneven, with the margin initially incurved, convex and umbilicate from the beginning, the umbilicus very deep, eventually the pileus deeply depressed, 8–20 mm. broad. — *Hymenophore* white or creamy white, eventually becoming pinkish in the fertile carpophores, easily separable from the context of the pileus, lamellae arcuate, decurrent to deeply decurrent, narrow (about 1 mm. broad), subclose to close, simple; spore print pale and dirty pink. — *Stipe* white, whitish, or sordid-pallid when old, glabrous or somewhat innately white-fibrillose, smooth, even, the base hardly noticeably mycelioid, versiform but usually as long as the pileus is broad, or longer, rarely shorter, and subequal, solid

or stuffed, sometimes becoming hollow, sometimes curved, 5–20 x 1–2.5 mm. — *Context* white, thin, very brittle when dried; odor farinaceous, or sometimes none; taste farinaceous, and slightly bitterish to mild.

Spores often agglutinate in fours, or in pairs, 6–10 x 3.7–5 μ , ellipsoid to ventricose-subfusoid, smooth, hexa- to octagonal because of (6)–8 flattened longitudinal ribs limited by obtuse or somewhat rounded edges which are not or hardly visible even in chloral hydrate, but become evident in an optical section with the long diameter of the spore pointing upward to the objective (like an egg seen “from above”), the wall thin and very easily collapsing, especially along the longitudinal edges, and then often appearing longitudinally ridged, some with a slight suprahilar depression, some only with an applanation, non-amyloid, hyaline to stramineous-hyaline; *basidia* 17–26.5 x (5)–6.7–9.5 μ , 4-spored, sometimes some 2- to 3-spored; *cystidia* and *cheilocystidia* none, but in some specimens many basidia abortive; *gill-trama* intermixed- subbilateral, non-amyloid, the hyphae without clamp connections; *cuticle* of the pileus (the thin silky covering) consisting of long, cylindric, appressed, smooth, more or less interwoven, clampless hyphae of 2–5.3 μ diameter, forming a loose to subdense tissue.

Chemical reactions: **FeSO₄**, somewhat grayish, almost negative. — **Methylparamidophenol**, negative.

Habitat: On open lawns, on bare ground and among grasses, also on roadsides and near the hammocks, never in the hammocks, fruiting from May to October. Gregarious.

Distribution: Common all over Florida.

Material studied: **Fla.:** Dade Co., Miami SW, 15th Road, October 1942, *R. Singer* F 1216/II (FH); Highlands Co., Highlands Hammock State Park, August 1942, *R. Singer* F 465 (FH); Alachua Co., Gainesville, several collections, among them **type** of *Omphalina floridana*, *W. A. Murrill* F 16223 (FLAS); and **type** of *Pleuropus minimus* Murr., *W. A. Murrill*, F 19980 (FLAS, FH).

Var. **submicropus** (Rick l.c.) Sing. comb. nov.

Pileus as in var. *floridanus*, but more distinctly sericeous or sericeous-fibrillose, smooth, convex with depressed center, larger, 20–30 mm. in diameter. — *Hymenophore* as in var. *floridanus*, close to crowded, sometimes somewhat forked; spore print pale and dirty pink. — *Stipe* white or pallid, innately fibrillose to somewhat mealy, especially on the apex, smooth, the bases connected by a very thin mycelioid membrane, solid, equal, but frequently with slightly thickened base and apex, sometimes flexuous, 10–25 x 2–4 mm. — *Context* white, very brittle when dried and also more or less fragile when fresh, rather thin; odor farinaceous; taste slightly bitter to mild.

Spores often agglutinate in pairs or in four, 5.5–6.8 x 3.5–4 μ , shaped as in var. *floridanus*; *basidia* 17 x 6.8 μ ; *cystidia* and *cheilocystidia* none seen; *hyphae* without clamp connections.

Habitat: In the hammocks (tropical hammock formations in Florida), on small debris and sticks, gregarious to cespitose, fruiting in Florida in October.

Distribution: Tropical Florida and Brazil, possibly all over tropical America.

Material studied: **Fla.:** Dade Co., Matheson Hammock, October 1942, *R. Singer* F 1252 (FH). — **Brazil:** type, Rio Grande do Sul, 1906, *J. Rick* (FH).

Rick indicates the spores as being $6 \times 2.5 \mu$, but in the type specimens I have found many foreign spores as well as many collapsed spores of the *Clitopilus*, and some of these fit in Rick's measurements. However, the non-collapsed spores of Rick's specimen perfectly agree with the above measurements taken from my Florida collection.

Var. aff. *floridanus*, ined.

Pileus as in the type variety but less distinctly sericellous. *Hymenophore* as in the type variety but often sterile. *Stipe* as in the type variety but less silky, more elongate in general and more frequently straight, sooner becoming hollow in large specimens, $3-17-(24) \times 0.7-2$ mm., the base glabrous in some specimens, white tomentose in others (inconstant). *Context* white, not very fragile, but very brittle when dried; odor farinaceous only when the carpophores are squeezed. *Spores* $7.7-9 \times 4.5-5.2 \mu$ (specimen from North Dakota); *basidia* $17.5-27.5 \times 6.5-8.5 \mu$, 2-, 3-, or 4-spored (very variable); *cystidia* and *cheilocystidia* none; *trama* and *cuticle* as in var. *floridanus*.

Habitat: On well-watered lawns on the soil, also in swamps on decayed leaves and wood, and on burned-over prairie sod, fruiting from June to August, gregarious.

This is another form, close to var. *floridanus* (Murr.) Sing., but obviously not entirely identical with it, found in the northern and western states.

Material studied: **Vt.:** Middlebury, July 1897, *E. A. Burt* (FH). — **Mass.:** Woburn, August 1943, *W. L. White*, det. Singer (*sterile form*) (FH). — **N.D.:** Kulm, June 1923, *J. F. Brenkle* (under a new unpublished name), *N. Dakota Fungi* 1613.

Sect. *Pleurotelloides* Sing. sect. nov.

A sectione praecedente stipite inconstanter formato vel haud persistente aut rudimentario vel complete absente differt.

Characters of the section: these are evident from the key p. 551, and the above Latin diagnosis. Type species: *Clitopilus pleurotelloides* (Kühn.) Sing.

9. *Clitopilus venososulcatus* Sing. spec. nov.

Pileo pallide albo, radiato-sulcato et venoso, farinaceo, sessili vel subsessili, 12-23 mm. lato; lamellis concoloribus, satis angustis, postice attenuatis, confertis; sporis in cumulo roseolis, $8-8.5 \times 4.5-5 \mu$, substramineis, striatulis; stipite nullo vel minutissimo, usque ad 1.3×0.6 mm.; carne inodora. *Habitatio:* Ad lignum emortuum prope Miami Floridae, U. S. A.

Pileus pallid white, radially venose and sulcate, mealy, not viscid, sessile or subsessile, 12-23 mm. broad. — *Hymenophore* white or pallid, becoming

dotted with pink from the spores, lamellae rather narrow (1.5–2 mm. broad), close, attenuate behind; spore print pinkish on white paper. — *Stipe* absent or rudimentary, and then concolorous and minutely mealy, not larger than 1.3 x 0.6 mm. — *Context* white, inodorous, very thin, very fragile.

Spores hyaline to pallid-stramineous, ellipsoid or short ventricose-subfusoid, or somewhat ovoid, longitudinally substrate because of flattened ribs limited by obtuse edges, in optical cross section obscurely angular, hexagonal or octagonal, 8–8.5 x 4.5–5 μ ; *basidia* 20–21 x 7–7.5 μ ; *cystidia* and *cheilocystidia* none seen; all *hyphae* without clamp connections.

Habitat: On dead portions of standing trunks of living *Ficus aurea*, and also on logs from the same host. October.

Distribution: Coastal Hammock in south Florida.

Material studied: Fla.: Dade Co., Matheson Hammock, October 29, 1942, R. Singer F 1344, **type** (FH).

This species is close to *C. pinsitus* (Fr.) Jossierand and *C. pleurotelloides* (Kühn.) Sing. It differs from both in the venose surface, and from the latter species also in being larger.

10. *Clitopilus pleurotelloides* (Kühn.) Sing. comb. nov.

Octojuga pleurotelloides Kühner, Le Botaniste **17**: 158. 1926.

Octojuga variabilis (Fr. *sensu* Karst. p. p., *non al.*) Fayod, Ann. Sci. Nat., sér. VII. **9**: 390. 1889.

Clitopilus variabilis Jossierand, Bull. Soc. Myc. Fr. **53**: 212. 1937.

Octojuga Fayodi Konr. & Maubl., Icon. Sel. Fung. **6**: 234. 1924–36.

Geopetalum viticola Murr., Bull. Torr. Bot. Club **67**: 2. 1940.

Pleurotus viticolus Coker, Journ. E. Mitch. Sci. Soc. **60**: 92. 1944.

Pileus pallid white, frequently becoming somewhat dirty grayish cream in age, opaque, white tomentose in the zone nearest to the substratum, smooth or transparently striatulate when moist, at least in the marginal zone when quite mature, glabrous but sericeous or finely villous when seen under a lens, circular, semicircular, or reniform, convex, sometimes attached by a resupinate portion and the free margin horizontally deflexed, the margin initially incurved, then repand and straight and occasionally radiately splitting, largest diameter of the non-resupinate portion of the pileus 1.5–10 mm. — *Hymenophore* pallid, lamellae moderately broad to very broad, subclose to rather distant, inserted, with entire or slightly uneven edges; spore print pale cinnamon pink. — *Stipe* absent, or present in very young specimens and then up to 1 mm. long, but soon becoming rudimentary and button-like, or entirely disappearing, concolorous, subpruinose to sericeous. — *Context* concolorous, very fragile, brittle when dried; odor none or very slight, farinaceous; taste mild.

Spores 5.5–9 x 3.5–5.8 μ (according to Kühner up to 12 x 6.2 μ), stramineous-hyaline, non-amyloid, ellipsoid to ovoid in outline but slightly hexagonal, octagonal, or decagonal with flattened to very slightly concave sides when seen in optical cross section, from one end; *basidia* 25–29 x

7.5–8.5 μ , 4-spored or a few 2-spored; *cystidia* and *cheilocystidia* none; *trama* non-amyloid; *hyphae* of the sericeous covering of the pileus cylindric, subinterwoven with some semi-erect ends, 2–4 μ thick, all *hyphae* without clamp connections.

Habitat: On dead cortex of tree trunks, on logs and dead branches, vines, (*Quercus*, *Eucalyptus*, *Salix*, according to R. Maire, *Cornus florida* and *Vitis* spec. according to Coker), and also on fallen needles of conifers, dead thallus of mosses (*Hypnum* according to Kühner), on bark of *Zizyphus jujuba*, also on herbaceous stems; June to December.

Distribution: Europe, Asia, and America, possibly cosmopolitan but often overlooked or misdetermined.

Material studied: **Fla.**: type of *Geopetalum viticola*, Alachua Co., Arredonda, 1938, Erdman West & W. A. Murrill (FLAS).—**USSR**: (formerly Finland), Kellomäki, Sept. 1940, R. Singer 5-836 (LE).—**India**: Ladhar, Sheikhupura, Sultan Ahmed, August 1944 (det. Singer), 1097 (FH).

Fayod based his name on an observation by Karsten, Mycol. Fenn. 3: 112. 1876: "Occurrit forma sporis minoribus (longit. 6 mm., crassit. 3–4 mm.), subhyalinis, qvalem in ramulis *Salicis Capraeae* prope Åbo mense Aug. legimus." Åbo is now Turku, Finland, and it may be of interest that I collected this species in Finland (or what formerly was Finland) on debris of rotten moss among sand near the railway station of Kellomäki, September 1940. There is, therefore, little doubt that Fayod was right in attributing this variety to what we now call *Clitopilus pleurotelloides*. But the type variety of *Agaricus variabilis sensu* Karsten is, as I have been able to confirm on the basis of Karsten's exsiccatum of this species distributed by him under #511 of the Fungi Fennici, determined correctly in the sense of the majority of the authors, i.e. it is a typical *Dochmiopus* (Agaricineae) with rough spores. Kühner was, therefore, justified in erecting a new name for the *Clitopilus* reserving the epithet "*variabilis*" for the *Dochmiopus*. The American collections do not differ sufficiently to separate them from *C. pleurotelloides*. They are, perhaps, slightly thinner with the lamellae accordingly broader and the surface of the pileus accordingly more striatulate, but striations are frequent in European specimens also, and the size of the lamellae and the diameter of the flesh vary considerably. The spores are slightly smaller in the types than they are in the European specimens I have studied, but Coker, who has re-collected Murrill's form in North Carolina, gives spore measurements which are exactly intermediate to almost identical with my European measurements (6.7–9 x 4.8–5.8 for the Kellomäki collection, 5.5–8 x 3.5–4.8 μ for Murrill's type). This again shows that the size of the spores is variable in this country as well as in Europe, though not more so than in some other species of this same genus. Murrill observes that "not one individual was found entirely resupinate, nor was there a stipe in the entire lot." If this latter observation should hold true for all American collections, including the youngest stages, it would be possible to distin-

guish Murrill's species as a form or variety of *C. pleurotelloides*. I doubt very much that the astipitate character of the American form is constant since it is not constant in the European plant.

EXTRALIMITAL SPECIES

Clitopilus crispus Pat., Bull. Soc. Myc. Fr. **29**: 214. 1913.

The type has been described from Indo-China. These specimens and an excellent colored picture are preserved at the Farlow Herbarium. There is also a spore print on blue paper which when transferred on white paper now is between "fawn color" and "wood brown." The mature spores are stramineous under the microscope, or, in dense piles, succineous, ellipsoid with some tendency to become hexagonal, with seven to ten (mostly eight) angles reinforced by longitudinal ribs and with furrows between them when seen in an optical cross section from one end, the ribs projecting about $0.4\ \mu$, $6.8\text{--}8.8 \times 4.3\text{--}5.2\ \mu$. This species is by far the stoutest of the small-spored *Clitopili*, but, nevertheless, belongs in the section *Scyphoides*.

Clitopilus orcelloides Pat. & Demange, Bull. Soc. Myc. Fr. **26**: 40. 1910.

The type, preserved in the Patouillard Herbarium (FH), comes from Indo-China. It has spores exactly as described by Patouillard, *i.e.* ellipsoid-subhexagonal or subrhomboid, or equally ovoid-ellipsoid, octagonal when seen from above, and then the angles reinforced by longitudinal veins which in the optical cross section look like knots, $5.5\text{--}7.5 \times 3.7\text{--}5.3\ \mu$, sometimes as short as $6 \times 5.2\ \mu$, the ribs projecting up to $0.3\ \mu$; hymenium and trama not very distinct in these specimens. There is an excellent colored picture in the unpublished "album" of V. Demange, executed by a native artist, and representing the type specimens in fresh condition. These vividly recall *Clitopilus scyphoides* var. *floridanus* from which the dried specimens are difficult to distinguish. However, the more angular spores, many of which are ornamented with ribs, cause me to consider *C. orcelloides* a different though related species of the section *Scyphoides*.

Clitopilus Passeckerianus (Pilát) Sing., Mycologia **34**: 66. 1942.

Pleurotus Passeckerianus Pilát, Atl. Champ. Eur., *Pleurotus* Fr., Ser. A, **9**–**10**: 49. 1935.

Pleurotellus Passeckerianus Konr. & Maubl., Icon. Sel. Fung. **6**: 361. 1938.

Octojuga Passeckeriana Sing., Ann. Mycol. **40**: 61. 1942.

This is a frequent weed-fungus in white-mushroom beds, and in my opinion is slightly different from *C. pinsitus* as well as from *C. scyphoides* var. *typicus* f. *mutilus* and *C. pleurotelloides*. For more descriptive data see the original account of Pilát, (1935) with photographs, and also Singer, (1942).

SPECIES IMPERFECTLY KNOWN

Clitopilus pinsitus (Fr.) Josserand, Bull. Soc. Myc. Fr. **53**: 210. 1937.

Agaricus pinsitus Fr., Syst. Mycol. **1**: 184. 1821.

This species, originally described from Sweden, has been redescribed by Josserand from France. Though it is impossible to prove that Josserand's interpretation is the only correct one, it seems to me that it is the best emendation of an otherwise superfluous Friesian species. I have not collected it myself, nor has it been found in America. It differs from *C. pleurotelloides* in being much larger and in having close, narrow lamellae.

SPECIES DUBIAE

Clitopilus cretatus (Berk. & Br.) Sacc., Syll. **5**: 702. 1887.

Described from England, this species is thought by Lange to be the same as *Pleurotus mutilus*, i.e. *Clitopilus scyphoides* var. *typicus* fa. *mutilus*. However, R. Maire (Publ. Inst. Botàn. **3**(4): 83. 1937) refers it to his genus *Clitopilopsis* because of Masee's indication on the spores of the type specimen of *Agaricus cretatus* Berk. & Br., Ann. Mag. Nat. Hist. ser. III. **7**: 373. 1861. In Masee's paper (*Grevillea* **21**: 81. 1893) are some not quite trustworthy measurements, and it may be unwise to take his word for it that these spores are not of the *Clitopilus*-type. A re-examination of the types at Kew will decide whether *C. cretatus* is another synonym of *C. scyphoides*, or a good species in some other genus.

SPECIES EXCLUDENDAE

Clitopilus abortivus (Berk. & Curt.) Sacc., Syll. **5**: 701. 1887.

This species, common in north Florida in winter, does not belong in this genus, but must be called *Rhodophyllus abortivus* (B. & C.) Sing., Rev. d. Mycologie **5**: 9. 1940. Other species formerly called *Clitopilus*, but having angular spores of the *Rhodophyllus*-type, must also be placed in the genus *Rhodophyllus* rather than *Clitopilus*. These are *C. undatus* Fr. (ut *Agaricus*), *C. cancrinus* Fr. (item), *C. albogriseus* Peck (item) (*Rhodophyllus albogriseus* (Peck) Sing., recte), and many others.

Clitopilus pallidus Heim, Treb. Mus. Ciènc. Nat., Barcelona **15**(3): 109. 1934.

Since *Clitopilus* is now used in the sense of Patouillard and Maire, the species of *Clitopilus em.* Heim, l.c. must go into *Clitopilopsis* Maire (Agaricineae). The type species of *Clitopilopsis* is *C. pallida* (Heim) Maire from Spain. Another species to be excluded is *Clitopilus togoensis* Henn., also considered to belong in *Clitopilus em.* Heim by Heim (1934) and Singer (1936), and certainly belonging in the Agaricineae rather than in the Jugasporaceae.

GENERA EXCLUDENDA

The following genera formerly considered to be allied to the boletes or other groups of the Boletineae, are now excluded from this suborder.

Filoboletus Henn. (belongs to the Tricholomataceae, Agaricineae).

Polyporoletus Snell (belongs to the Scutigeraceae, Clavariineae).

Fistulina Bull. ex. Fr. (belongs to the Fistulinaceae, Cyphellineae).

Volvoboletus Henn. (is a parasitized or abnormal *Amanita*).

GENERA DUBIA

Fistulinella Henn.

Melanomphalia Lange.

Gymnogomphus Fayod.

HARVARD UNIVERSITY
CAMBRIDGE, MASS.

THE MOST IMPORTANT LITERATURE ON THE BOLETINEAE, ESPECIALLY THOSE OF FLORIDA

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