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New and Interesting Species of Basidiomycetes V*)

By Rolf Singer (Tucumán, Argentina).

Descriptions of Russulae.

In some previous papers, the author has given descriptions and redescriptions of little known species of *Russula;* but comparatively little has been published about the North American species since they were first described, mainly by Peck and Burlingham. North American species were redescribed by the present authors in his „Type Studies" (1) and in the first part of the present paper (2). But in the type studies all the emphasis was on the analysis of the existing types. Some species were also redescribed earlier on the basis of material collected by A. H. Smith, especially in the West Coast regions (Washington to California), fewer in Michigan, Tennessee and North Carolina.

Meanwhile, the author had occasion to study the rich *Russula* flora of Florida (which had been visited by Burlingham, Beardslee, and was especially worked over by W. A. Murrill who described many dozens of new species from there), collect in the Northeast from Maine to Massachusetts and New York, and to spend an entire collecting season at the Biological Station of the University of Michigan in the northern part of the State of Michigan where by Russulas were the main subject of research.

In spite of all the data obtained, the situation remained much as it had been: the lack of modern descriptions of Russulae is felt most strongly in regard to the American Russulae, inasmuch as all recent monographic work had been carried out in the old world and predominantly with old world material, at least as far as fresh specimens are concerned. In order to give complete descriptions which are useful for comparison, fresh material is more necessary in the Russulaceae than in any other family of fungi. It is therefore quite understandable that American species have been misinterpreted by various European authors, especially when nothing but the original diagnosis was available. The original descriptions of all these species, with only three or four exceptions, consist of data which do

*) Earlier contributions under this title were published in Mycologia 37: 425—439. 1945; II: Pap. Mich. Acad. Science, Arts & Lett. 32: 103—150. 1948; III; Sydowia 4: 130—157. 1950; IV. Mycologia **47**: 763—777. 1955.

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not take into consideration any of the requirements of descriptive work published by Maire nearly 50 years ago, not to speak of those introduced between 1927 and today; some would have been considered faulty even in Fries's days. Specimens were particularly difficult to obtain since until recently most of Burlingham's types were deposited in her private herbarium and practically unobtainable while, at the same time, Murill's Florida types are likewise hard to obtain. Since fresh spore prints, data on the taste of young specimens, and chemical reactions are not obtainable at all, even where good type specimens are available, the knowledge of the American Russulae is further reduced. And to make matters worse: even the existing redescriptions are so scattered in the literature of recent years that the pertinent data are incomplete in the libraries of most specialists.

With the present paper, I have attempted to remedy the difficulties enumerated above, even though a monographic work on the North American Russulae is still impossible. Yet, the genus is so large — there are about 150 species known from the United States alone — that a redescription of some poorly known species as well as the description of some unknown species seems to be a necessity. Consequently, the present paper emphasizes American Russulae rather than the world flora of *Russula*. In addition to the 28 species described or redescribed before *), we give here 82 additional descriptions. Together, these sets of descriptions North American Russulae should give a rather clear picture of about 70% of the Russulas of that continent, as far as they had been described up to this date.

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*) *R. smithii Sing.*, Bull. Soc. Myc. Fr. 54: 140. 1938; *R. chrysodacryoides* Sing., ib. p. 144 (as *R. ? mordax*); *R. maxima* Burl., ibid. p. 148; *R. basifurcata* Peck, ibid. p. 152; *R. roseipes* ssp. *dictyospora* Sing., ibid. p. 155; *R. placita* Burl., ibid. p. 157—158 (as *R. abietina*); *R. persobria* Sing., ibid. 55: 228. 1939; *R. tennesseensis* Sing., ib. p. 230); *R. fellea* ssp. *simillima* (Peck) Sing. ib. p. 236 (as *R. simillima*); *R. polycystis* Sing., ib. p. 238; *R. melliolens* Quél., ib. p. 259; *R. fallax* (Fr.) Sacc. sensu Sing., ib. p. 262; *R. subalutacea* Burl., ib. p. 273; *R. subveternosa* Kauffm. ex Sing., ib. p. 275; *R. ventricosipes* Peck, Mycologia 34: 69. 1942; *R. vinacea* Burl., ib. p. 83; *R. humidicola* Burl., ib. p. 86; *R. compacta* Frost & Peck apud Peck, ibid. 35: 143. 1943; *R. peckii* Sing., ibid. p. 147; *R. anomala* Peck, ib. 39: 174. 1947; *R. albiduliformis* Murr., ibid. p. 178; *R. albida* Peck, ib. p. 180; *R. rubescens* Beardsl., ib. p. 182; *R. ferrotincta* Sing., ibid. 37: 428. 1945; *R. pulverulenta* Peck, ibid. p. 431; *R. rubriceps* (Kauffm.) Sing. Pap. Mich. Acad. Sc. 32: 112. 1946 (1948); *R. pseudolepida* Sing., ib. p. 114; *R. americana* (Sing.) ibid. p. 118.

In the list given above, we have not admitted those species of which a revised or amplified description is given in the present paper.

Only those species are indicated of which we were able to give a full and reasonably complete description. As for type studies, we have to refer to the respective papers.

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The author is indebted to the John Simon Guggenheim Foundation. He was a fellow of the Foundation during his work in Florida 1942/3, and again while this paper was edited; also to the authorities of Huntington Forest (University of Syracuse, School of Forestry), the Agricultural Experiment Station at the University of Florida, and the Biological Station of the University of Michigan, and personally to Dr. A. H. Smith, Mr. Erdman West, and Dr. W. A. Murrill, for valuable herbarium material as well as for their kind personal cooperation.

Descriptive terms in the genus *Russula* are so standardized, and have been so frequently defined that the only form illustration necessary or desirable in order to improve on the descriptions would be colored plates of the species involved. Some colored illustrations were made under the direction of the author by Mrs. McKnight, and are deposited at the University of Michigan, Museums's Building.

In all the descriptions that follow below, the colors are those of Ridgway (R.) and Maerz & Paul (M & P); only the color of the spore deposit on white paper is given in Crawshay terms. We use uniformly fresh spore deposits, the shade being determined before the material is put in the drier. The spore print is then left with the specimen while drying, and if any change in spore color is noticed due to dehydration, it is indicated. We have not adapted Blum's method of using only dehydrated spore prints with a new scale because of a whole series of reasons. In the first place, standard spore prints correlated with those used by Blum are not easily available in any region outside Europe. In the second place, while the dehydration process comes to a certain equilibrium after an average lapse of time, it is by no means certain that further changes in color do not take place, and it appears impractical to define a definite time after collection when spore prints should be evaluated. Furthermore, it was shown in our study of the boletes (3) that best diagnostic results were obtained by using fresh spore preparations.

The characterization of the different types of spore ornamentation is the same as used by the author in previous papers and explained both in his monograph (4) and in his „The Agaricales (Mushrooms) in modern Taxonomy" (5). The classification is also adopted from the latter paper although it has been found necessary to introduce two additional subsectional entities which will be discussed suo loco.

Section *Compactae* Fr.
Subsection *Archaeinae* Heim.

Russula earlei Peck, N. Y. State Mus. Rep. **67**: 24. 1903.

Pileus stramineous or alutaceous („warm buff" to „cinnamon

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buff", „chamois", „honey yellow", R.; „buttercup", „honeysweet", „samovar" M & P), some portions soon becoming lighter colored because of the breaking-up of the cuticle showing the white flesh in the crevasses, at maturity often appearing rimulose or innatefibrous and sublacertae with ridges and crust-like patches often showing in a radial pattern, subviscid-opimous when young but becoming drier at maturity, rarely more distinctly viscid, with non-striate and non-sulcate acute margin, with inseparable or only very slightly separable cuticle, convex and obtuse to almost hemisphaeric when young, soon becoming more applanate, the center often somewhat depressed and the margin frequently irregular and uplifted in age, 40—110 mm. broad. — Lamellae at first nearly whitish but soon becoming „warm buff" (R.) or darker, pl. 9 C 1, later „auteuil" to pl. 11 H 7 (M & P) or „honey yellow" (R.), varying from heterophyllous to irregularly intermixed with but a few lamellulae but never quite equal, very fragile, distant (38—43) or subdistant, broad to very broad (about 10—11 mm. broad), adnate to subdecurrent, almost simple or a few forked, broadest in front, with even edge; spore print white, almost A, far from B. — Stipe white to concolorous with the pileus, with a fine covering of cottony appressed fibrils at first, or glabrous, later either smooth or with subreticulate rugosities, occasionally spotted or pitted, tapering downward, rather versiform, solid, 25—73 ⇌ 6—25 mm. — Context white to yellowish, somewhat rigid but very brittle, unchanging; taste mild; odor none to rather strong and unpleasant.

Spores 5—8.5 ⇌ 4—5.5 μ, mostly 6.8—7.5 ⇌ 5—5.5 μ, ellipsoid, orn. 0.3—0.4 μ, type VI, rarely VI—VIII or IV, warty in circumference because of the relative size of the ornamentations; basidia 46 ⇌ 7.5 μ approximately; cystidia of the edge of the lamellae 34—80 ⇌ 4.3—6.8 μ, cylindrical with a small amount of scattered granular contents at the tip or in the middle portion, rarely the whole upper portion with granular contents; hymenophoral trama chiefly vesiculose with scattered filamentous hyphae and oleiferous hyphae of 5—10 μ diameter intermixed; cuticle of pileus consisting of more or less interwoven but tangential hyphae which are rather long and 2.1—7.5 μ broad, loosely arranged in a mucilaginous matter, some of them terminationg in hair-like bodies which are clavate or constricted in the middle, 3—8.5 μ broad; dermatopseudocystidia none.

In mixed woods of pine and oak, often under *Rhododendron* in the mountain woods of the southern Appalachians and in mesophytic hammocks farther south, on the soil, fruiting from July until September. New York to Tennessee, and south to Alabama and North Florida.

Material Studied: *N.Y.*: Type from Port Jefferson, NYS, NY. — *N.C.*: Highlands, Cove, A. H. Smith, det. Singer 10349, MICH,

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FH, and other collections from the Great Smoky Mountains area. — *Fla.*: Planera Hammock, Alachua Co., Singer F 3442, FH.

This interesting species is most obviously related to the tropical subsection *Archaeinae*. Their most striking character is their similarity with representatives of the genus *Hygrophorus*. They can easily be mistaken for Hygrophori in the field, especially in temperate regions where Hygrophori abound as they do within the geographic area of *R. earlei*. In spite of this superficial similarity, there is no real transition toward the *Hygrophoraceae* since all the essential characters of *Russula* are preserved in this subsection.

Subsection *Plorantes* Bat.

Russula vesicatoria Burl., Mycologia **36**: 118, 1944.

Pileus white, sooner or later with sordid ochraceous buff zones or stains, viscid only in the marginal half, or entirely dry, dull and unpolished even in wet weather, with adnate or, on margin, separable cuticle, with acute, pubescent, arched smooth margin, otherwise likewise smooth or slightly areolate, with broadly or narrowly depressed disc or umbilicate, otherwise convex with initially involute margin which may be upturned in old specimens, 75—150 mm. broad. — Lamellae white to creamy white with a very slight salmoneous tinge, narrow, not broader in the outer third (2—5 (7) mm. broad), close to crowded, even very crowded, frequently with numerous, even alternating lamellulae, frequently with forked ones, attingent-adnexed to subdecurrent; spore print pale cream, B, to between B and C, but with the color quality of D. — Stipe white, smooth unpolished, somewhat pubescent in youth and eventually glabrescent and staining somewhat like the pileus from the base upward, slightly to strongly tapering downward, more rarely equal (in Western specimens) or more irregular (subbulbous, ventricose, etc.), very hard and solid, 20—45 ⇌ 20—28 mm., rarely reaching 45 mm. in diameter. — Context white, unchanging or becoming somewhat stained with ochraceous buff in age, firm, almost compact and hard in the stipe, not brittle; taste mild, but becoming increasingly burning acrid (even causing blisters on tongue and lips according to Dr. Burlingham) and at the same time slightly bitter just before the acrid taste becomes unbearable; odor agreeable, comparable to that of fresh (not dried) *Lactarius camphoratus*, becoming unpleasant in very old and drying material.

Spores 7.5—10.5 ⇌ 5.5—8.8 μ, most frequently 8.7—9.5 ⇌ 7.5—8.8 μ, orn. 0.5—0.7 μ, or 0.5—0.9 μ, type III b, in fewer spores II, III a, IV, V, II—IV, generally rather inconstant but predominantly echinulate with a broken reticulation; basidia and pseudocystidia much like those of *Russula delica;* hymenophoral trama with numerous large

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sphaerocysts ,not as in *Lactarius piperatus*; all hyphae without clamp connections.

KOH on context negative, or pale citron yellow. — $FeSO_4$ on context and lamellae sordid and pale salmon color to salmoneous. — Anilin on the lamellae melleous with a slate gray to caesious margin, or more glaucous after a while in most specimens. — Phenol on the surface of the pileus "vinaceous fawn" (R.), on context chocolate. — Sulfoformalin negative.

On the earth under *Pinus taeda* and *P. palustris* and perhaps other pines. Fruiting from May until November. Florida and Pacific Coast.

Material studied: 1. Eastern collections: Fla: co-type, NY. — Flatwood east of Gainesville, Singer, F 2402, 2402 a, F 1918, F 1918 a (?), F 1918 c, d, e. FH. — Paradise, Alachua Co. Murrill May 13, 1939, det. Singer, FLAS (?). — Western collections: Wash.: Near Lake Angeles, 4000 fl., Olympic Mountains, A. H. Smith, MICH, F, FH. — Ore.: East Fork Salmon, Mount Hood, Gruber & Smith 19643, 10292, MICH, F, FH.

The description of this characteristic species was prepared for publication when Miss Burlinghams diagnosis appeared which plainly refers to the same species. The Western material is obviously conspecific with the Florida type although the bitter component of the taste has not been noticed by A. H. Smith in his careful field notes. If this should be a coordinated character in correlation with the more frequently equal stipe and perhaps less severely burning taste, the Western form may be distinguished as a geographical race just as *Gomphidius vinicolor* ssp. *californicus* is distinguished from *G. vinicolor* ssp. *jamaicensis*. The Florida form is one of the most intolerably acrid species of *Russula*, and, at the same time, exhibits extremely crowded lamellae in some collections, but always showing characteristically close lamellae as the *Lactarius piperatus* group. This, in connection with the color and habit of the species, make it easy to confuse it, in the field, with one of the Lactarii sect. *Albati*. However, the anatomy of the lamellae shows that this is a true *Russula* of the subsection *Plorantes*, most closely related to *Russula fuegiana* Sing. from Tierra del Fuego, and less closely with *R. delica*.

Subsection *Nigricantes* Bat.

Russula nigricans (Bull. ex Fr.) Fr. ssp. **eccentrica** (Peck) Sing. comb. nov.

Syn.: *Russula eccentrica* Peck, Bull. N.Y. State Mus. **150**: 61. 1911.

The specific identity of Peck's species with the common European *Russula* has been established by author in previous studies. The American representatives of this species, however, show a consistenly larger number of lamellae than their European counter-

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parts, and should, as is here proposed, be treated as a geographic race.

Lamellae rather thick, 5—7 per cm. at 1 cm. from margin of pileus, about 81 reaching the stipe in an average of mature specimens, sordid cream-white, with few to numerous coarse anastomoses and frequent low forkings but simple at the stipe, 8 mm. broad (per 86 mm. diameter of pileus. Taste mild and somewhat like that of *R. adusta,* with a slight acrid aftertaste.

The pileus is white and opaque at first like in *R. albonigra,* and sometimes distinctly viscid (if collected in rainy weather), but drying out rapidly, often eccentric (but just as often or more frequently perfectly central). All other characters are in close agreement with those of typical *R. nigricans,* including the microscopical and chemical characters.

In mixed woods on the earth, also in pure coniferous and pure frondose woods, often in groups, fruiting in spring until fall. Probably widely distributed over the continent.

Material studied: Numerous herbarium specimens, including the type, NYS. Fresh material from *Mich.*: Maple River, Emmet Co., July 27, 1953, Singer N 835, MICH, CF. — *Wash.* Andersen Creek Trail, Mt. Baker Nat. Park, August 19, 1941, A. H. Smith 16276, MICH, F, FH. — Ermine Creek Trail, September 11, 1941, ibid. no. 16870. — Also material from Florida.

Russula densifolia (Secr.) Gillet, Champ. Fr., Hymen. **1**: 231. 1876.

Syn.: *Agaricus adustus densifolius* Secr. Mycogr. **1**: 476, 1833.

Pileus pallid on margin and pallid soot-gray on disc, or entirely sordid whitish, then soon becoming gray-brown to umber all over ("cattail" to "partridge") (M&P), and eventually dirty brownish gray to brownish black from the middle outward, distinctly viscid at least when young, but drying out rather rapidly, in dry condition slightly shining, or with shining areas, especially in the marginal half when dried, not entirely opaque, sometimes actually glutinous in the disc area, with poorly differentiated cuticle which is separable only on the margin where it is often finely pubescent but soon glabrescent, later sometimes becoming partly verrucose, but usually smooth, with smooth, acute margin, convex, soon umbilicate, eventually applanate-concave, 55—140 mm. — Lamellae whitish a very slight grayish cream to reddish tinge in many specimens, but not with an orange reflex, reddening when bruised and finally, slowly, grayish to black, close to almost crowded (always within the limits of 10—15 per cm. at 1 cm. distance from the margin), narrow (6—11 mm., mostly around 8 mm. broad), regularly intermixed-

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heterophyllous, subdecurrent or decurrent, little or not anastomosing; spore print white, A. — Stipe pure white, becoming reddish where scratched, eventually gray, grayish black or concolorous with pileus, finely pubescent-pruinate, glabrescent and naked in age, smooth, sometimes becoming faintly reticulate gray on reddish ground in age, equal or attenuate below, or in the contrary, bulbous below, solid, firm, hard, 22—80 ⇌ 12—58 mm. — Context white, turning reddish to pinkish red by autoxidation (in about 1—4 minutes), eventually gray to black, almost compact, taste mild, but insipid with a (1 min.) more or less acrid (in American specimens always slightly acrid or subacrid) aftertaste, not bitterish at all, but leaving a slightly cooling sensation on the tongue; odor of orange juice when just beginning to ferment, sweetish, not (as in *R. adusta*) of old wine barrels, but variable and sometimes more unpleasant like that of *Boletus satanas* and *B. miniatoolivaceus,* or even farinaceous.

Spores 7—9 ⇌ 6—7.5 μ, orn. 0.2—0.5 μ, type III a to III a—VII, sometimes some III a—II; basidia and cystidia rather long and narrow, the latter often denser at edge, but in other cases lamellae homomorphous, pseudocystidia numerous, bluing in SV, about 46 ⇌ 4.5—6 μ, mostly cylindrical; on epicutis of pileus with numerous vermiform bodies which turn brown or blue in SV; similar elements in the surface layer of the stipe.

$FeSO_4$ on flesh causing little reaction (slightly reddish grayish), but causing the autoxidation to black to increase in rate, but if applied after blackening has begun, the discoloration is sordid salmon colored. — KOH often provoking blackening. — Phenol: chocolate. — Anilin on lamellae at first negative, after 5 min. light copper brown, no gray ring; on flesh after 3 min. pale grayish red. — Formalin on flesh and lamellae deep carrot red.

On the ground in frondose and mixed woods. Probably all through U.S.A., Europe, North Africa, and Caucasus. Fruiting from May until fall.

Material studied: Numerous collections in Europe and Caucasus, in U.S.A.: *Fla.**): Gainesville, S i n g e r F 2011, F 2202, FH. — *Mich.*: Reese's Bog, Cheboygan Co., S i n g e r N 539, F, MICH, and various other collections.

The lamellae of this species are not quite as crowded as in the *R. densifolia* described by R o m a g n e s i in R o m a g n e s i & K u h n e r (6), yet the species is not identical with *R. adusta* var. *rubens* as described by R o m a g n e s i, and is obviously identical with the *Russula densifolia* sensu Sing., J. S c h ä f f e r et al. from

*) The Florida collections differed in their $FeSO_4$ reaction: pink on flesh before autoxidation, green or olive after autoxidation. I find similar data on this reaction with European material.

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Europe. It is also strikingly different from the true *R. albonigra* as described below.

Russula albonigra (Krombholz) Fr., Mon. Hymen. Suec. **2**: 324. 1863.

Syn.: *Agaricus alboniger* Krombholz, Naturgetr. Abbild. Schw. Heft **9**: 27. 1845.

Russula sordida Peck, Bull. Buff. Soc. Nat. Sc. **1**: 57. 1873.

Russula adusta var. *albonigra* (Krlz.) Fr. ex Rea, Brit. Bas. p. 459. 1922.

Pileus white, becoming cinereous toward margin, eventually blackish or fuscidulous, slightly viscid in youth during rain but drying very rapidly and quite opaque, involute in youth, smooth all over, with acute margin, with adnate cuticle, subtomentose in center and at first on extreme margin, convex, often umbilicate, eventually with applanate margin and widely depressed center, or entirely concave, often irregular, 60—120 mm. broad. — Lamellae white, sordid white, rarely with a slight orange-pallid tinge (not so in Florida), rather narrow (3—6 mm. broad), staining black where touched and often with black edge, sometimes anastomosing, sometimes separating from the flesh at the stipe, thin, often strongly forked, usually with at least some forked ones, more or less subdecurrent to decurrent when mature, at first attenuate-emarginate-attingent, close (8 lamellae per 1 cm. at 1 cm. distance from margin in an average); spore print pure white, A. — Stipe pure white, usually with the base browning, becoming black where scratched and later becoming blackish all over, initially pubescent-pruinose, solid, then stuffed, eventually somewhat hollow in many specimens, central or sometimes eccentric, versiform, 30—55 ⇌ 15—35 mm. — Context white, or whitish, definitely never reddening at all, blackening directly on exposure within 1 min. when fresh, more rarely becoming bluish black or fuliginous (not so in U.S.A. specimens seen), firm and compact, seemingly carbonaceous when old taste mild, slightly acrid after a few seconds, especially in the lamellae, in very old specimens persistently mild and very slightly bitterish in the flesh; odor fruity or none when young, eventually developing an "adusta odor" (of old wine barrels.

Spores 7—8 ⇌ 7 μ orn. type III a—VII; basidia 40—52 ⇌ 7—9.5 μ; cystidia 55—80 ⇌ 6—10 μ, not reacting as true macrocystidia: not bluing at all in Maire's SV, in concentrated solution sordid lilac with brown granules; pseudocystidia absent in the covering layer of pileus and stipe; hyphae without clamp connections.

$FeSO_4$ grayish red, in blackened portion sometimes (Fla.) green. — Metol: immediately "blackish purple" to "deep naphthalene violet"

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(R.). — Anilin: copper red on lamellae. — Formalin: red, in darkened areas brownish pink, quick reaction. — On the ground in woods, mostly in frondose woods, fruiting from June until fall.

Material studied: Numerous collections from both Europe (France, Austria, Germany etc.) and North America, especially North and Central (to Highlands Hammock State Park) Florida, north to Vermont and Northern Michigan (Cheboygan, Co., Carp Creek, Singer N 651, F, MICH).

Russula adusta (Pers. ex Fr.) Fr. fa. *rubens* Romagnesi, Bull. Soc. Mycol. Fr. **59**: 71. 1943.

Pileus white on margin, fuscous in center, soon entirely fuscous, viscid, distinctly shining when dry, convex, often umbilicate then with depressed center, eventually flattened or concave, with acute margin, smooth all over, 50—100 mm. — Lamellae cream color almost from the beginning, close (8—11 per 1 cm. at 1 cm. distance from the margin of pileus), rather narrow, attingent, eventually subdecurrent, heterophyllous; spore print pure white, A. — Stipe white, reddening where scratched, eventually slowly sordid fuliginous, firm, subequal, but versiform, initially slightly pubescent but glabrescent, solid, eventually with cavities, 20—75 ⇌ 10—30 mm. — Context white or whitish, weakly reddening by autoxidation on exposure, eventually becoming (slowly) more or less grayish fuliginous; taste quite mild; odor characteristically and constantly of old empty wine barrels.

Microscopical characters more or less as in *R. densifolia.*

$FeSO_4$ and formalin as in *R. densifolia.*

On the ground in coniferous woods and under conifers. Fruiting in summer and fall.

Material studied: Numerous collections in Europe. *Mich*: Bodi Lake, Luce Co. Singer N 1373, F, MICH.

In some collections, no reddening whatsoever is observed, and these are then considered as typical *R. adusta. R. adusta,* even if reddening can be distinguished from *R. densifolia* by the more shining pellicle of the dry and dried material. Aside from that, we always find young specimens at least subacrid in *R. densifolia* and mild in *R. adusta.* The number of lamellae seems to be a less reliable character as far as the differentiation between our *R. densifolia* and *R. adusta* is concerned than between the European form, as characterized by Kühner & Romagnesi on one hand, and *R. adusta* on the other. *R. albonigra* was consistently misdetermined *R. adusta* in the older French literature, and what Murrill called *R. adusta* in Florida is likewise *R. albonigra.*

The author does not pretent that the knows all the species or froms of this group. It is quite possible that the *Russula densifolia*

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with extremely crowded lamellae indicated by Kühner and the strongly viscid but color-changing (blackening) form repeatedly mentioned in North American notes actually exist as distinguishable species. But the author has not re-collected them.

Section *Decolorantes* Maire.

Russula subsericeonitens Murr., Torr. Bot. Cl. **66**: 156. 1939.

Syn.: *Russula furcatifolia* Murr., Lloydia **6**: 210. 1943.

Pileus purplish lilac, pl. 48 L 8, with the margin "cyclamen" (M&P) and the center sometimes almost black, almost even when dry, slightly viscid when quite fresh and moist, drying out rapidly, glabrous or subglabrous, with smooth, rounded margin, the cuticle separable with some difficulty, convex, becoming depressed in the center, or entirely concave in age, 45—55 mm. broad. — Lamellae pure white, not becoming yellowish, moderately close to almost subdistant, adnate, anastomosing, moderately broad to almost broad in the frontal third, mostly equal, forked behind and near the middle, or not at all, adnate, subfree, or subdecurrent; spore print white, A to between A and B, nor reaching B. — Stipe pure white, becoming cinereous, rather short and thick or of average shape, glabrous but subrugulose, light in weight, spongy, cinereous white in dried condition but white inside unless very old, 35—55 ⇌ 10—17 mm. — Context white, often sligthly grayish or sordid when old; taste mild or subacrid after a while of mastication (the latter observation only made by Murrill); odor none.

Spores short ellipsoid, rarely subglobose, hyaline, with coarse to more rarely fine and typically dense (when mature) warts projecting 0.5—1.0 μ, most frequently near 1 μ high, forming an ornamentation of type III b or IV, fewer spores of type III a and V; basidia 36—46 ⇌ 10—12.2 μ., 4-spored; pseudocystidia 50—75 ⇌ 8—15 μ, with granular to finely banded contents all over, moderately numerous to rather numerous on sides and edges (edge homomorphous), protracted and acute, more rarely obtuse, or frequently appendiculate, the average rather voluminous; epicutis of pileus consisting of filamentous hyphae, primordial hyphae and dermatopseudocystidia which may be about equally numerous, or sometimes pseudodermatocystidia which are clavate and filled with yellow banded contents, most abundant, primordial hyphae "empty" but punctulate-incrusted, yet sometimes transitions between these and the dermatopseudocystidia observed; hypodermium consisting of filamentous hyphae forming a dense cutis which appears vinaceous in NH_4OH.

Formaline: reddish after a few seconds.

In low hammocks, mesophytic hammocks and mixed (hardwoods and conifers) woods on the ground, fruiting between October and

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January in Florida, July and August in regions farther north. From Virginia south to Florida.

Material studied: *Va.*: Mountain Lake, Giles Co. Singer, V 171 FH. — *Fla.* Alachua and Clay Counties, Types of *R. subsericeonitens* and *R. furcatifolia.* FLAS.

This species is unique because of the combination of color of pileus and spore print. It may have a larger area than can now be foreseen.

Russula subdensifolia Murr., Mycologia **33**: 441. 1941.

Russula subflava Sing., Ann. Mycol. **40**: 87, 1942, non Murr. 1941.

Pileus white when young on margin, with "pale cinnamon pink" zone between the margin and the center, the latter somewhat paler than "massicot yellow" (R.), in older caps white or yellowish white mixed with "cartridge buff" to "cream buff" or "chamois", or ground color between "cartridge buff" and pallid with numerous large yellow spots or areas ("cream buff", "colonial buff", "Naples yellow", or "mustard yellow", R.), never deeper colored, subviscid to viscid when wet, drying rapidly and then opaque, glabrous or somewhat subvelutinous on the margin, with the cuticle separable over the outer third of the radius with smooth margin which later becomes short sulcate, or more rarely widely tuberculate-sulcate, subobtuse then obtuse to rounded in front, outside the marginal area always smooth, convex-subumbilicate, then convex with depressed center, eventually applanate or concave, 29—75 mm. broad. — Lamellae white or whitish, staining gray in age or on drying, becoming light ochraceous and in color like those of *Russula decolorans,* attenuate-adnexed to subfree, close to subdistant, narrow to broad (3—7 mm. broad), mostly medium broad (4—5 mm.), anastomosing, some forked, but more often simple and not even bifurcate at the stipe, some few (3—5) lamellulae often present, sometimees separating at the stipe, ventricose or not and usually broadest in the marginal third; spore print ochraceous, G. — Stipe white, becoming gray to black where handled, equal or tapering upward, rarely with enlarged apex, subrugulose, glabrous, solid, or stuffed, 30—62 ⇌ 9—18 mm. — Context white, reddening where exposed to the air, especially where scratched, if young and fresh enough, always becoming more or less gray or grayish when old, medium fragile; taste mild; odor none or slightly fruity, in age somewhat of camembert cheese.

Spores 8.8—10.5 ⇌ 6.8—8.5 µ. orn. 0.7—1.7 µ, mostly 1,4 µ VI; basidia 30—40 ⇌ 11.7—14.3 µ, 4-spored; cystidia with banded contents, all over, apparently macrocystidia, very crowded on edge, fusoid with appendage, or acuminate like pencils; subhymenium predominantly filamentous with very few subisodiametrical elements

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intermixed; epicutis of pileus of irregularly arranged hyphae without any visible pigmentation, loosely packed, 3—3.7 μ in diameter, among them some oleiferous hyphae (5.5—6.5 μ in diameter) which reach the epicutis as cylindrical dermatopseudocystidia with banded contents; hypodermium yellow, consisting of subinterwoven, mostly tangentially arranged filamentous hyphae; all hyphae without clamp connections.

KOH on pileus negative. — Formalin red on context of stipe. — Phenol chocolate. — $FeSO_4$ often greenish gray where the flesh was already gray, otherwise a mixture of pallid pink and sordid gray (normal). — Metol very strong reaction to purple-violet in a few minutes. — $FeSO_4$ on pileus negative.

On the ground in woods and low hammocks (*Quercus virginiana* and *Pinus palustris*) and in high pine woods under *Pinus australis* and *Quercus virginiana.*

Material studied: *Fla.,* type of *R. subdensifolia,* FLAS — Gainesville, May 19, 1943, Singer F 1975, FH. — Highlands Hammock State Park, Highlands Co., Singer, September 6, 1942, F 607, FH.

This species seems to form mycorrhiza with either *Quercus* or *Pinus,* or with both, most probably with *Pinus.* According to the description given by Beardslee (7) it is obviously distributed northward to North Carolina, but we have seen no specimens. Nevertheless, the characters are precisely those of Murrill's species and cannot be reconciled with those of *Russula flava* Rom. although the spores are given as nearly white by Coker for his *Russula flava,* an indication which we may consider as either erroneous or based on misdetermined (both for *R. subdensifolia* and *R. flava*) specimens. *R. decolorans* is indicated by Coker as having spores of the same color cathegory as *R. flava* whereas in reality both have pale ochraceous spores which could not possibly be called nearly white unless the observation is based on a very thin layer observed on black paper. Our own spore prints have been taken from three different collections and proved to be constant as indicated.

Russula subobscura Murr., Bull. Torr. Botan. Cl. **66**: 258. 1939.

Pileus "jasper red" or "light jasper red" (R.), in the center more in the color of *R. emetica* ssp. *emetica* but the margin sometimes as light colored as "peach red" or even "rose doree" (R.) while the central portion may be as intensely colored as "Brazil red" but more frequently rather uniformly colored and more deeply colored when young, glabrous, viscid, opaque when dry, smooth, or more rarely subrugulose, with partly or more rarely entirely separable cuticle, with smooth, later 7—10 mm. wide tuberculate-sulcate obtuse margin,

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convex, then with depressed center, 35—65 mm. broad. — Lamellae white or whitish when young, soon becoming ochraceous in the color of *R. decolorans,* subclose to moderately close (90 reaching the stipe), with 0—16 lamellulae, simple or somewhat forked, anastomosing, broadest in frontal third (4.5—6.5 mm.), ventricose or not, adnexed to almost adnate; spore print not obtained, but must have been light ochraceous from scratch sample and from color of mature lamellae (between D and E), "ochroleucous" according to Murrill. — Stipe white, stuffed or hollow, becoming gray or brownish gray when handled and on drying, often reddening before graying, equal or subequal, sometimes with a slight constriction in the middle, 43—52 ⇌ 8—16 mm. — Context white turning dull red when fresh and young through autoxidation, later becoming gray on handling and in age or in the drier; taste mild or very slightly and tardily acrid when quite fresh and young; odor slight, not characteristic.

Spores 7.8—11.5 ⇌ 7—9.4 μ, mostly 8—10.5 ⇌ 7.8—8.5 μ, orn. 0.7—1.5 μ, mostly around 1 μ, type VI (few VI—VIII), never crested or connected by fine lines; pseudocystidia numerous, acute, with banded contents; epicutis an ixotrichodermium consisting of filamentous hyphae (erect or ascending) with rounded or rarely acute tips and a diameter of 1.8—2.8 μ, and numerous dermatopseudocystidia which are sometimes longer than the whole diameter of the epicutis since they arise directly from the hypodermium, all or some with yellow contents, with abundant banded contents but the latter often forming small corpuscules in the middle of an indivisual cell, 4.7—9.5 μ broad, clavate above and consistently rounded at the tips, the upper portion often projecting beyond the tips of the outermost hyphae but then recurved and appressed and thus causing the levigate appearance of the cuticle; oleiferous hyphae also often present; hypodermium red because of an intracellular dissolved pigment which is rapidly destroyed (1 minute) by NH_4OH in mounts; no subhypodermial zone differentiated.

Formalin: reddish with flesh.

In mixed woods, e. gr. in low hammock on the base of a pine, or in mesophytic hammock under oak, fruiting in September and October. Alabama and Florida.

Material studied: *Fla.*: type of *R. subobscura,* FLAS. — Planera Hammock, Alachua Co., Oct. 19, 1938, Murrill, FLAS. — Highlands Hammock State Park. Highlands Co., September 2, 1942, Singer, F 479, FH. — *Ala.*: Robinsons Springs, October 1942, Burke, no. 170, FH.

This species is rather rare. It is very close to *R. rubescens* (described previously to the present paper by the author) which differs, most manifestly, in the colors. The stipe is very slightly pink

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in parts of two collections by Murrill but this may be a secondary discoloration and has therefore not been incorporated in the description. Murrill describes this species as purplish and darker than indicated here, but the specimens have been compared carefully, and there does not seem to remain any doubt about their identity. The word purple is notoriously ambiguous since different authors give it a different meaning. In one of Murrill's specimens the spore print is indicated as white, but no spore print is found and the spores are strongly yellowish under the microscope.

Russula occidentalis (Sing.) Sing., Lilloa **22**: 705. 1951.
Syn.: *Russula vinosa* ssp. *occidentalis* Sing., Pap. Mich. Acad. Sc., Arts & Letters **32**: 114. 1946 (1948).

Pileus "Prussian red" to "hematite red", "deep purplish vinaceous", mixed greenish or olive tints ("veviter green", later "tea green") or buff ("cream buff" on disc, and "dark olive buff" on margin), the margin rarely "light cinnamon drab" in age with the disc becoming "olive buff" (R.), all these colors occurring in various combinations, but the margin most frequently remaining "dull lavender" (R.), the center often almost black, glabrous to subpruinose-subpubescent and opaque when dry, but apparently glabrous and viscid when wet although drying very rapidly, more glabrescent in the center than on the margin, with the cuticle separable from halfway to completely, with smooth or short tuberculate-sulcate margin and subobtuse, later rounded in front, otherwise with smooth surface, convex with broadly depressed center, more applanate when quite old, 50—150 mm. broad. — Lamellae white, then pale cream color, dirty cream in age, the edges either unchanging or becoming sordid brownish when bruised or graying, crowded to subdistant, equal, occasionally forked, especially in the inner third, narrow (up to 6 mm. broad) to broad (10—15 mm. broad), broadest in the marginal third, narrowed to the stipe, anastomosing, rather thick; spore print varying from intensity of D and tone quality of between C and E to between E and F (nearer to E). — Stipe white, the base at times exhibiting sordid yellowish blotches, usually becoming slowly cinereous or sordid, usually strictly unpolished, sometimes initially exuding watery drops, then slightly subpruinose to subvelutinous but glabrescent, spongy-firm but becoming hollow in age, equal, or nearly so sometimes longitudinally short-rugose at the apex, otherwise smooth to subrugulose, sometimes attenuate and curved at the base, rarely swollen-ventricose, 50—100 ⇌ 15—30 mm. — Context white ,unchanging in young material, if not quite fresh, otherwise usually changing when bruised, scratched, or cut, at first to reddish, or directly (and then more slowly) to cinereous or gray,

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the reddening more localized in the stipe, rather firm at first, but fragile in age; taste mild; odor weak.

Spores 9—14 ⇌ 8.5—12 μ, orn. (1) 1.5 (2) μ high, of type VI, or, in some collections, up to half of the spores of type IV, yet the general impression always that of isolated echination; basidia 50—55 ⇌ 14.2 μ, 4-spored; pseudocystidia with banded contents, more often acute than obtuse, 80 ⇌ 10—10.8 μ; epicutis of pileus formed by hyphae which are equal, smooth, "empty", clampless, 1—3.5 μ thick, filamentous, and making up a trichodermium which becomes depressed in an early stage; hyphae of the hypodermium similar but more repent and pigmented.

On the ground, on needles, under *Larix, Pinus,* and *Tsuga* in mixed woods, fruiting in August and through October. Washington and Oregon, and east to Idaho.

Material studied: *Idaho:* Copeland, C. H. Kauffman, MICH, LE. — *Wash.* Mt. Baker, Timberline Camp, Aug. 24, 4000 ft, Smith 16359 a, FH. — *Ore.* Mt. Hood, East Fork Salmon River, Gruber & Smith 19160, and numerous collections from the same general neighborhood, FH, F. — Coos Head, Coos Co., M. Doty 931, F.

Section *Ingratae* Quélet.

Subsection *Fistulosinae* Heim.

Russula burlinghamiae Sing., Bull. Soc. Myc. Fr. **54**: 154. 1938.

Syn.: *Russula insignis* Burl., North Amer. Flora **9**: 212. 1915.
Russula insignita Burl., Mycologia **31**: 497. 1939.

Pileus with indistinct concentrically elongated appressed yellow squamulae ("deep chrome" to "cadmium y." M & P) on slightly less deep colored ground ("Inca gold", "gold leaf") with some "raw siena" spots in center when old, dry, glabrous, except for the squamulae and an occasional (perhaps of foreign origin?) arachnoid covering which is limited to the disc and is likewise bright yellow, with smooth and acute margin, convex-applanate, with strongly depressed center, 82 mm. broad. — Lamellae cream color, 8 mm. broad, close to crowded, narrowed-free with slightly decurrent tooth, little anastomosing, nearly all equal, very few forked, eventually assuming a light ocher color, spore print C (Crawshay) in intensity, D in tone quality. — Stipe whitish with sometimes a trace of the yellow squamulae otherwise observed on the pileus, ventricose, hollow, 90 × 18 mm., the middle portion reaching 24 mm. — Context white, compact but becoming fleshy-spongy in age even in the stipe; taste mild; odor characteristic, difficult to describe, weak.

Spores 7—9.2 ⇌ 5.7—7.8 μ, orn. of type II (mostly II—II b), III a to III b (mostly III b), also, more rarely, IV or II—IV; pseudocystidia

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somewhat variable in size and shape, at least the upper half, but often much more filled with banded contents which turn blue in SV the same kind of cystidia also present at the edge of the lamellae; epicutis of pileus consisting of hyphae and numerous long, septate primordial hyphae with clavate ends, 4—8.3 μ broad; hypodermial layer- a cutis- formed by long filamentous subinterwoven-subparallel hyphae, the primordial hyphae rich in protoplasm, but no bluing elements in SV mounts.

$FeSO_4$ on context of stipe normal (avellaneous-pinkish-gray). — SV (macroscopically) negative.

On the ground in low oak-pine woods.

Material studied: *Mass.*: near Cohasset, Oct. 1947, Singer, FH. — Also the type, NY.

The description given above is entirely based on the material collected in Massachusetts which is considered as identical with the type material analysed earlier.

Subsection **Crassotunicatinae** Sing. subsect. nov.

Pileo sicco vel subsicco, sparse pigmentato nec laeto; stipite albo, subbrunnescente; $FeSO_4$ ope virescente; odore saporeque vix iucundis. Typus: *R. crassotunicata* Sing.

Russula crassotunicata Sing., Bull. Soc. Myc. Fr. **54**: 132. 1938.

Pileus white, with finely innately fibrillose brown punctation scurfy, but at first perfectly smooth, eventually finely areolate, dry, or viscid and drying very rapidly with thick and almost leathery cuticle, with smooth margin, peeling thickly over one half of the radius toward the center, with acute margin, convex, soon narrowly depressed in the center, eventually somewhat flattened and expanding, 40—80 mm. broad. — Lamellae white more or less stained brownish by bruising subdistant, narrowed toward both ends, medium broad, subintermixed to almost alternating; spore print white (A, Crawshay, but darkening in the herbarium in 10 years, to C. Crawshay). — Stipe white, becoming brown spotted, finely but distinctly roughened subfurfuraceous in a horizontally banded pattern, or anyhow not longitudinally rugulose as the in the majority of the Russulas, never quite smooth, subequal, but sometimes tapering upward or downward, hollow, rather firm, 30—33 ⇌ 9—11.5 mm. (rather short). — Context white, with an inclination to stain brownish as in *R. compacta,* rather firm; taste bitterish and slightly burning after a while in the throat, never quite mild when fresh; odor of trimethylamine.

Spores, basidia and pseudocystidia as indicated in the original description (l. c.), the latter bluing in SV; cuticle of pileus in mounts

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from fresh material consisting of slightly thickwalled and incrusted (usually cinnamon in KOH) and therefore opaque-refringent hyphae, some pseudocystidia present, either ampullaceous or acute and in the latter case subulate, bluing in SV, also some non-bluing short-septate slightly swollen bodies present; surface layer of the stipe consisting of hyphae with thick walls (0.8 μ in young specimens, soon thicker), intermixed with numerous dermatopseudocystidia which turn partly blue in SV, 67—90(—170) ⇌ 9—10.5 μ, also some slightly thickened multiseptate bodies present which are not dermatocystidioid, and some spherocysts or clavate bodies (not bluing in SV) seen (e. gr. 12 ⇌ 8.3 μ); all hyphae without clamp connections.

$FeSO_4$ pinkish in rind of stipe, turning to sordid green inside the stipe. Anilin red (as in *R. compacta*) — KOH on pileus not causing brown discoloration.

On the ground in small groups under conifers e. gr. *Tsuga canadensis* in mixed woods. In Northern Michigan fruiting from July until August. Also in the Pacific Coast States, fruiting there in early fall.

Material studied: Type, from Washington, also additional material from Michigan: Tahquamenon Falls State Park, Luce Co., Singer N 861, N 978, MICH, F.

The recently collected fresh material of this species observed in northern Michigan shows clearly that this species is chemically as well as in numerous other regards most closely related to *Russula compacta* which we have redescribed in another paper. The latter species differs in habit and size, in the smooth surface of the stipe, in taste, close lamellae, the cuticle which is separable over $^2/_3$ of the radius of the pileus and by far not so thick and leathery-tough as in *R. crassotunicata,* and by the merely rimulose surface of the pileus. *R. compacta* is much more common in North America, especially in the Eastern and Southern States (where it reaches Florida) than *R. crassotunicata* which seems to be another example of a species having a predominantly western area but reaching, apparently through the boreal forests in Canada, far to the east reaching the northern portion of the Great Lakes region. Another example of this sort is *Russula robinsoniae,* and, among the boletes, *Suillus tomentosus* (Kauffm.) Sing.

R. crassotunicata and *R. compacta* both belong in a single group. Not knowing the fresh specimens of the former and nothing about its micro- and macroscopical reactions, I classified *R. crassotunicata* with *R. fistulosa, R. burlinghamiae* and similar species of the *Ingratae* while *R. compacta,* where the $FeSO_4$ and anilin reaction as well as the trimethylamine odor had come to my attention as early as 1941, was originally inserted with the *Xerampelinae,* a bright

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colored group with darker spore print. Considering the close affinity of these species, it seems now that they were both misplaced, and should go into a subsection aff. *Fistulosinae* but autonomous.

Subsection *Obtectae* Sing.

Russula granulata (Peck) Peck, Ann. Rep. N. Y. St. Mus. **53**: 843. 1900.

Syn.: *Russula foetens* var. *granulata* Peck, l. c. **39**: 57. 1886.
Russula obtecta Sing., Bull. Soc. Mycol. Fr. **55**: 233. 1939.

Pileus "chamois" or "honey yellow" or darker, reaching "tawny olive" on the disc (R.), or "rattan" to "rattan" mixed with "bunny" with an intermediate zone colored "chipmunk" and center sometimes reaching "cocoa" (M & P), generally much in the colors of *R. foetens*, very viscid to subviscid, the surface sometimes characteristically minutely furfuraceous-granulate all over or in part or at least concolorously punctate with innate (confluent with cuticle), not separable granose elevations which are rather hard, denser toward the middle, with somewhat separable pellicle, with acute, sulcate and eventually long pectinate margin, the striation being in an average somewhat shorter than that of *R. foetens*, convex, soon with depressed center, with eventually repand, sometimes even uplifted margin, smooth, but often with a rugose continuation of the marginal striation toward the center, 30—75 mm. broad. — Lamellae white, then "cream color" (R.), often indistinctly staining brown on injury, spotted with reddish or concolorous specks on edge in age, attenuated but adnate, some forked at a lower level and appearing inserted, but also some lamellulae intermixed, broader toward the margin, close, rather narrow (4—6 mm.), with or without anastomosing or crisp decurrent lines on the apex of the stipe, continuing the lamellae; spore print D (Crawshay), tone almost of E, but distinctly paler, but considerably darker than in *R. foetens*. — Stipe white with partly dirty or pale brownish to fulvous brown lower portion, with the squamulae near base varying between pl. 6 L 7 and "chalet r." (M & P), often, especially in dry places, developing a cinnabarinous tone at the base, but the fresh basal mycelium inconspicuous and sordid white, equal or with attenuate apex, or tapering downward or subequal to ventricose, at first firm, later spongy to stuffed and hollow, 20—60 ⇌ 10—20 mm. — Context white or whitish, concolorous with pileus under the pellicle; taste disagreeable to slightly bitter and fetid and at the same time slowly very slightly to strongly burning acrid; odor variable, sometimes only with the oily component of *R. foetens*, but sometimes with a distinct fruity odor of its own.

Spores 7.6—8.8 ⇌ 6.6—7.2 μ; orn. 0.6—0.9 μ, of type VI or more rarely IV, VIII, etc.; basidia 36—43 ⇌ 6.6—7.9 μ, some to 10.8 μ broad;

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sterigmata about 6 μ long; pseudocystidia 55—80 ⇌ 8—10 μ, acute or obtuse, usually fusoid, with abundant yellow (in NH_4OH) contents, blue in SV, often appendiculate (appendage 2.5—6 μ long), or with constricted apical portion, numerous; squamulae and granules of pileus and stipe formed by hyphae which are hyaline to ochraceous or brown, with obtuse or acute tips, usually filamentous, septate and most frequently constricted at the septa, 3—4 μ thick, some incrusted and reminding one of primordial hyphae; pseudocystidia also present among the ordinary and primordial hyphae, with blue (SV) granular contents; dermatopseudocystidia also present (but likewise few) on the surface of the stipe, also blue granular inside (in SV mounts).

KOH on surface of pileus varying greatly, but always giving a strong reaction, from distinctly brown (much deeper than the color of the pileus ever becomes at pH = 6) to red ("autumn glory" to "chrysanthemum" M & P), same reaction on the brownish lower half of the stipe, on adult dried pileus dark brown. — HNO_3 almost negative on all surfaces. — Phenol chocolate on flesh. — $FeSO_4$ between "woodland rose" and "rose beige" (almost normal) on flesh of stipe.

In mixed woods on the ground, usually under hardwoods mixed with *Tsuga canadensis* or *Picea rubra,* also in pure stands of *Picea,* or *Fagus,* perhaps also with pines and oaks, generally not very selective in regard to association, fruiting from July until October, Vermont, Massachusetts and New York, south to Pennsylvania, Virginia, and Tennessee, west to Michigan.

Material studied: *Vt.,* A. Hibbard, FH; *Mass.* Harvard, Dadmun, FH; *NY:* Type of *R. foetens* var. *granulata,* NY, NYS; *Va.* White Top Mountain 5000—5500 ft. Singer, V 181, V 215, FH; *Tenn.* Clearfield Co., L. K. Henry, FH. — *Mich.* Pellston Hills, Emmet Co., Singer N 769, MICH, CF; Tahquamenon Falls State Park, Luce Co., Singer N 1297, N 1335, MICH, CF.; Carp River, Cheboygan Co., N 1181, MICH, F, type of *R. obtecta* Sing. LE, MICH.

This species is often mistaken for *R. foetens* or *R. pectinatoides,* both these species often being much like *R. granulata* in colors, habit, and habitat, but they differ in the microscopical characters of the spores, in the spore print color, in the lack of the characteristic granulation of the pileus, and the KOH reaction, also, to a certain degree in odor and taste.

Subsection *Subvelatae.*

Russula mutabilis Murr., Bull. Torr. Bot. Cl. **67**: 146. 1940.

Pileus "burnt sienna" to "hazel" with some "pale pinkish buff", occasionally with "xanthine orange" and "chestnut" hues, glabrous or more rarely finely granular in places, but initially always with a delicate pulverulence as in *R. subvelata* and *R. pulverulenta,*

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densely dusted on the margin which is consequently "primulin yellow" (R.), glabrescent with age, viscid or subviscid, with somewhat separable (over half the radius if quite fresh) cuticle, with acute, pectinate (but shorter pectinate in an average than *R. foetens*; only 4—6 mm. long) margin, rarely long-pectinate as in *R. foetens* and *R. pectinatoides* (up to 10 mm. long from the extreme margin inwards), pulvinate to convex, umbilicate from the beginning, later more repand, 85—104 mm. broad. — Lamellae "cream buff" collectively, "ivory buff" singly (in side view), then becoming "cream color" (R.), some of them usually with brownish to blackish brown edges, or punctate, narrow (4—6.5 mm. broad), crowded, many forked, especially near the attachment to the stipe, more or less intermixed, irregularly adnexed to adnate-subdecurrent with decurrent tooth, little or not anastomosing; spore print about B (Crawshay). — Stipe pallid at apex, stained with "honey yellow" below, "wax yellow" (R.) at the base, becoming "flame scarlet" (R.) on drying, in older specimens "ferrugineous" to "Kaiser brown" and somewhat "carob brown", hollow, sometimes obese, very slightly to decidedly attenuated toward the base, glabrous or initially subpulverulent at the base, 35—65 ⇌ 16—43 mm. — Context pallid, mostly yellow in the base; taste very acrid; odor exactly as in *R. foetens*.

Spores 8.5—10.5 ⇌ 8—9.5 μ, usually around 10.2 ⇌ 8.5 μ, orn. 0.8—1.3 μ, of type IV and IV—II, more rarely III b—VIII, V, VI, with coarse spines; basidia 40—45 ⇌ 10—12.5 μ, 4-spored, clavate or subclavate-cylindrical and the uppermost portion attenuate; gloeocystidia 45—65 ⇌ 8—16 μ, honey yellow, very numerous on the sides of the lamellae, and extremely numerous on the edges but edges not exclusively consisting of cystidia, with extremely polymorphous appendages which are hyaline and sometimes vesiculose and finally bursting, deep blue and somewhat granular in cresyl blue; subhymenium consisting of small contorted short bodies forming a narrow (25—30 μ in diam.) layer of subcellular character which grades into the hymenopodium, a layer of about 17—20 μ diameter consisting of elongate elements which are strongly interwoven but still slow a tendency to run parallel with the hymenium surface and axillarly in the sense of the lamellae; hymenophoral trama vesiculose, but intermixed with many connecting hyphae and gloeovessels; floccons of the young margin consisting of fascicles of hyphae with numerous clavate ends, so numerous and dense that they appear to sprout, with moderately thickened (up to 0.6 μ) walls, hyaline to (mostly) bright cinnamon in NH_4OH, smooth, growing in all directions, the diameter of the end cells 3—5.5 μ; underneath the velar layer there is an epicutis proper, consisting entirely of fibrillose elements which are either hyphal and empty or conducting

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bodies with granular contents (gloeovessels), both these elements either hyaline or cinnamon-melleous but less brightly colored than the elements of the velar layer; hypodermium hyaline and gelatinized, consisting of radially arranged hyphae and gloeovessels, the latter scattered; context consisting of spherocysts and a large number of filamentous connective hyphae as well as some gloeovessels, none of these elements amyloid; no clamp connections.

KOH on the fresh pileus surface: darker; on the velar layer; characteristically "English red" to "Brazil red" (R.); on the context: darkening to the color of the pileus. — NH_4OH on the dried base of stipe: immediately horse-chestnut color; on dried lamellae: immediately alutaceous tan. — HNO_3 on surface of pileus: darker. — Metol: strong positive reaction to purple and then black.

Under *Quercus laurifolia* and *Q. virginiana* on the ground, mostly gregarious, fruiting from May until October in Florida, not observed in the tropical zone.

Material studied: Alachua Co., type and various authentic collections e. gr. F 8825, F 18079, F 8796, all from Gainesville and nearby, Murrill coll., FLAS. — Gainesville, Singer, F 2154, F 2154 a, F 2154 b, F 2715, FH. — Marion Co., Murrill, FLAS.

The species corresponding to *R. foetens* in the subsection *Obtectae* is *R. granulata,* and the one in subsection *Subvelatae* is *R. mutabilis* while *R. subvelata* and *R. pulverulenta* correspond to *R. pectinata.* The red colors of *R. mutabilis* appear only on drying or with KOH, but not naturally as in fresh material of *R. pectinatoides* or in many collections of *R. granulata,* and they do not appear in primordial and very young stages in the fruiting bodies only to disappear in the mature carpophores as is the case in *Russula ventricosipes.* The velar layer is not only extremely similar to that of the related Russulas (*R. subvelata, R. pulverulenta,* both redescribed by the author in previous papers) but also to that of *Pulveroboletus ravenelii.*

Subsection *Foetentinae* Melzer & Zvára.

Russula laurocerasi Melzer in Melzer & Zvára, Arch. Prir. Vyzk. Č. 17 (4): 99. 1927..
Č. 17 (4): 99. 1927.

Syn.: *Russula foetens* var. *subfoetens* (Smith??) Mass., Brit. Fung. Fl. **3**: 70. 1893.

Russula foetens var. *laurocerasi* (Melzer in M. & Zv.) J. Schaeffer ex Konr. & Maubl., Icon. Sel. F. **6**: 410. 1938.

Pileus pale brownish ocher, usually paler than on *R. foetens,* center sordid ocher brown, glabrous and not granular but with short to long tuberculate sulcation or pectination on the margin which is acute, with slightly separable pellicle, globose, then convex, often

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umbilicate, eventually depressed to concave, 40—105 mm. broad. — Lamellae whitish, then pale cream color, often brown-spotted, close, exuding watery droplets when quite fresh, sinuate, often strongly anastomosing, medium broad; spore print B (Crawshay). — Stipe white or whitish and somewhat brownish shaded, glabrous, subequal, ventricose or tapering upward, solid, then hollow, without red base, 40—80 ⇌ 11—32 mm. — Context white or whitish, unchanging; taste acrid and at the same time often quite bitter; odor of maraschino cherries (of nitrobenzene with a fruity component), different from that of *R. foetens.*

Spores 10—14 μ in diameter, subglobose, orn. 1.3—1.9 μ, type II, some spores II—III b or just III b, few IV to V; basidia 11.5—16 μ broad, 4-spored; pseudocystidia very numerous and versiform, some enormous, always very broad, mostly 15—19 μ in diameter, bluing in SV; bluing pseudocystidia also present on the surface of pileus and stipe, but often inconspicuous, narrow and irregular and not too distinct in other than SV mounts.

KOH on surface of pileus staining slightly darker, but considerably less so than in *R. granulata.*

In mixed woods on the ground, often in groups, Europe and North America. Fruiting in summer and fall.

Material studied: *Mass.*: West Roxbury, Singer, FH. — *Va.*: Mountain Lake, Giles & Co., Singer, FH. — *Mich.*: Maple River, Emmet Co., Singer, N 893, N 893 a, MICH, F. — Tahquamenon Falls State Park, Luce Co., Singer, N 1241, MICH, F. — *Wash.*: Andersen Creek and Shuckton Inn, A. H. Smith 16265, 16212, MICH, FH, LE, F.

This species is very close to *R. foetens,* and there has been a certain uneasiness, among specialists, as to its recognition as an independent species. After long observation of this species, I am inclined to believe that it deserves the status of an independent species, not so much because of the strong difference in the spore ornamentation — the crested bands are not always so high and long as in the most typical collections — as because of a correlation of several minor characters such as the odor, broader hymenial elements, larger spores, etc.

Two species are also very closely related to *R. laurocerasi* Melzer but seem to have a smaller area in North America or to be absent from the continent altogether. These are *R. punctipes* Sing., originally described from China, also occurring in Japan (*R. senecis* Imai), and a form differing from this in having the same granular excrescencies of the surface of the pileus as *R. granulata* and which may not be specifically different from *R. punctipes,* observed in Florida (Highlands Hammock State Park, Highlands Co., Singer F 585, FH) and

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still undescribed. It is barely possible that the granular character of the pileus is not always clearly manifested in dried material and has escaped me when describing *R. punctipes*. In case this suspicion should turn out to be unfounded, the Florida form has to be described as new. It is now preserved under the herbarium name *Russula arcyospora* Sing. ined., and belongs undoubtedly in the subsection *Obtectae*.

Russula pectinatoides Peck, Bull. N. Y. State Mus. **116**: 43. 1907.

Syn.: *Russula consobrina* var. *pectinatoides* (Peck) Sing., Hedwigia **66**: 205. 1926.

Russula livescens (Batsch ex) Quélet var. *depauperata* Lange, Dansk Bot. Ark. 4 (12): 35. 1926.

Pileus "Saccardo's umber", "buckthorn brown", "Dresden brown" and sometimes reaching "bone brown", but more frequently lighter colored, in paler tints than the above e. gr. "snuff brown" to "tawny olive" or "cartridge buff" with "cinnamon buff" or "clay color" (R.) spots, usually the paler color prevailing in the marginal region and the deeper one in the center, or with deeper colored innate fibrils or sulcations with pallid interstitia, frequently burnished gold to "clay" (M & P), later often deeper in center, turning more ferrugineous with age in many specimens, with viscid then dry and opaque surface, with the cuticle separable in wet condition over the outer two thirds of the radius and at least 10—15 mm., but in dry condition nearly inseparable from the flesh of the pileus, with acute, later subacute pectinate-sulcate and somewhat tuberculate margin (over on to two thirds of the radius), often innately radially fibrillose, but glabrous (no velar layer), not showing any granular protuberances, convex with umbilicate or depressed center, with eventually uplifted margin which may become variously split or wavy and irregular, 20—100 mm. broad, in some collections tiny as in the type collection, in others predominantly large, sometimes all sizes mixed in a single group, most frequently 35—70 mm. broad. — Lamellae pale cream and often with a slight grayish tint, sometimes slightly staining brownish, but usually only on the edges when bruised but often turning brownish on the edges when old, often showing ferrugineous-rufous spots when not fresh but only under certain circumstances and not constantly so, narrow to rather broad, broadest in the middle third and almost sickle shaped, or else rather flat below, very frequently with numerous forked ones, rarely almost simple, the inserted ones often merely forked at a lower level, but true lamellulae also often present, in other collections all equal, adnate, more rarely adnexed, emarginate or slightly sinuate, hori-

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zontal or subarcuate, more or less anastomosing, subclose to subdistant; spore print C (Crawshay). — Stipe white or with a slight brownish or grayish tinge or spots in these colors which enlarge as the carpophore grows older or becomes less fresh, usually becoming early "vinaceous russet" or "vinaceous rufous" dotted at the base, or sometimes strigose in these colors, in M & P terms around pl. 5 I 12 at the base, sometimes tomentose there, and the dots expanding more toward the apex in older specimens, sordid hyaline when handled when still white, smooth, stuffed, soon becoming hollow, pruinate at apex when young but soon glabrescent, versiform, 20—75 ⇌ (5)7—22 mm. — Context white, pale sordid gray or sordid brownish under the cuticle at least of the older specimens, eventually tending to become somewhat grayish all over or else with fulvous-ferrugineous discolorations, elastic-fragile to unelastic-brittle; taste mild but disagreeable, more rarely with a slight bitterish taste, and very rarely very slightly and tardily acrid as an after-taste; odor rather variable especially in old specimens, usually of fresh fish or codliver oil, but usually rather weakly so.

Spores 7—9 ⇌ 6—8 μ, orn. up to 0.6 μ (rather low), of type III b, III b—VIII, IV, IV—VIII with IV—II ridges, or V with VI—VIII chains, etc., never predominantly VI; basidia 32—60 ⇌ 9—11 μ; pseudocystidia numerous, versiform but mostly ventricose-fusoid, frequently with a constriction above, often strikingly appendiculate, blue in SV, 69—125 ⇌ 8—10 μ; epicutis and hypodermium with filamentous hyphae and conducting elements which turn partly somewhat blue in SV; same structure in the surface layer of the stipe; some "hair"-shaped hyphal ends (cystidioid, not bluing) here as well as on the surface of the stipe.

Anilin on lamellae and context: sordid brownish, not red. $FeSO_4$ dirty gray on context. KOH on pileus very slightly darker.

Under various frondose trees with special preference for grassy watered ground and parklike stands, more rarely in coniferous or mixed stands in woods and forests, fruiting from May until October, in Europe, Caucasus, North Africa, North America, in Florida reaching the northern zone, western limits unknown, but certainly reaching Michigan.

Material studied: Numerous collections in Europe (France, Switzerland, Germany, Austria, Sweden, etc.), Caucasus. Spain, Les, Catalunya, Singer, BC. — Caucasus, between Nakra River and Kwa plateau in Swanetia, Singer, W. — USA.: *Mass.* Cambridge, Singer, FH. — *N. Y.* type, NYS. — *Va.* Beanfield, near Mountain Lake, Giles Co. R. Singer, FH. — *Fla.* Gainesville, Alachua Co., Singer F 2153 FH., F 2153 a, FH. — *Mich.*, Cross Village, Emmet Co., Singer N 814, MICH, F.

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This species is not rare in the United States, and a comparison with the type shows distinctly that this is the species described by me as *R. consobrina* var. *pectinatoides* from Europe, also described by various European authors under various names, among others by Schaeffer as *R. pectinata* "Bull". The authentic (see Sydowia **5**: 459. 1951) *Russula pectinata* of Fries's is rather on the large side of what we currently find to be the size of this species (see below), and Peck's original material is on the lower side of the range observed in *R. pectinatoides*. The acrid taste indicated by Fries excludes, among other things, *R. pectinatoides* from the synonymy of *R. pectinata* Fr. What then is *R. pectinata*? Surely not *R. sororia*, the common acrid counterpart of *R. pectinatoides* since a number of characters attributed to it by Fries do not agree, including the fact that *R. sororia* was well known to Fries as a variety of *R. consobrina*. It must be, therefore, the — in Europe uncommon and often overlooked — third species of the complex or stirps around *R. sororia*, the *R. pectinata* in our sense, and perhaps the species recently described as new by Kühner & Romagnesi (though thus far, a nomen subnudum), described below under its correct name:

Russula pectinata Fr. Epicrisis p. 358, 1838.

Syn.: *Russula consobrina* var. *pectinata* (Fr.) Sing., Hedwigia **66**: 206. 1926.

Russula consobrina var. *minor* Anonymus, Trans. Brit. Mycol. Soc. **3**: 145. 1910.

Pileus avellaneous stramineous with umber or bister shades, or more rarely stramineous and more brownish in the middle, more pallid near margin or more reddish brown near margin or in spots and the center or the whole ground color tending to be more pallid; often "Saccardo's umber" but somewhat paler and mixed with pallid areas, or less yellowish than "chamois", spotted or mixed with "cinnamon buff" or "clay color" on "cartridge buff" ground, etc. (R.), convex, then flat with depressed center, long pectinate and slightly tuberculate on margin (up to one third, sometimes even more, of the radius), smooth or more often innately very finely and minutely verruculose-radiately-rugulose, with separable cuticle up to one half of the radius (but with some difficulty even fresh), slightly viscid and shining when moist, drying opaque, with acute, later subacute and eventually sometimes obtuse margin, the cuticle occasionally exceeding the margin and projecting as a very narrow denticulate-crenulate rim which remains pallid, 24—67 (100) mm. broad. — Lamellae cream pallid, rarely grayish pallid, sometimes slightly

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staining brownish when bruised and much like those of *R. pulchella* although lighter colored, becoming slightly paler than "cartridge buff" (R.), equal or with intermixed lamellulae, simple or with more or less numerous forked ones, especially near the stipe, narrowest in the middle, or linear, or broadest in the middle, rather narrow to broad, more often rather broad, 2—8 mm. broad, usually 6—8 mm. in average sized carpophores, close to subdistant, attenuate at the stipe and decurrent or not, varying from subfree to decurrent with tooth, anastomosing, not exuding droplets; spore print between B and C (Crawshay). — Stipe white, not bright colored at the base, but sometimes with glaucous ring at the apex, becoming pallid white, and frequently somewhat brownish or grayish from the base upward, with scarce and indistinct basal tomentum, or if distinct, the basal tomentum strigose and white, stipe ventricose below (very frequently so), or tapering upwards or downwards, very minutely pruinose or glabrous or more distinctly pruinose at the apex, rather fragile with more rigid rind, stuffed to hollow, always hollow when mature, 20—43(50) ⇌ 6—14(17) mm. — Context white, eventually slightly brownish or grayish in the base of the stipe or sligthly yellowish gray in the rind of the stipe, under the cuticle usually with a narrow zone which is stramineous or grayish ochraceous, at first subrigid but soon elastic-fragile when maturing, unchanging, (except for the staining brownish of the lamellae in some collections); taste slightly to strongly acrid, usually distinctly so and always noticeably acrid after some mastication, at the same times with a more or less developed disagreeable by-taste; odor very variable in old specimens, e. gr. strongly of smoked herring, of camembert cheese, spermatic, etc., in younger carpophores almost invariably pleasantly of *Russula mariae* or *Lactarius volemus*.

Spores 6—10 ⇌ 6—8.5 μ, mostly 7.3—9 ⇌ 6.2—8 μ, orn. 0,6—1.0 μ, of type VI (very few spores of type IV, V, IV—II, VIII, more frequently practically all of type VI); basidia 35—40 ⇌ 8—10 μ; pseudocystidia rather numerous, 40—78 ⇌ 7—10 μ, versiform, often appendiculate (appendage 0.5—9 μ long), bluing in SV in the upper portion or almost entirely; edge of lamellae homomorphous; oleiferous hyphae (2.5—4 μ in diameter) in the cuticle, otherwise the epicutis made up of filamentous "empty" elements.

KOH on fresh cuticle staining slightly more ochraceous cinnamon, the dried cuticle becoming slightly darker. — $FeSO_4$ on the context reddish gray. — Formalin in most cases negative with the flesh, rarely brownish or light pink on the fresh context of the stipe (reaching "pale salmoneous salmon").

On the ground, preferably under conifers and Fagales, especially in moist depressions and low woods of the temperate zones and in

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low hammocks of the subtropical zone, also on watered lawns under trees, occasionally in mesophytic or high hammocks and in various mixed stands and in one occasion found to climb the woody trunks of *Sabal palmetto* as well as *Carya macrocarpa.* Fruiting from May until November, in Europe (where it is rather rare) and North America (where it is not uncommon especially in the southern States, very common in Florida).

Material studied: Austria: Gross Russbach, Niederoesterreich, Singer W. — France: Sèvres, Vincennes, in frondose grove, H. Romagnesi, and Bois de Coye, Singer, both near Paris, FH. — Sweden: Djurgarden, Sven Rundguest, det. Singer, S. — U.S.A.: *Mass.,* near Harvard, Singer, FH. — Purgatory Swamp, Singer, FH. — *Va.,* a collection by C. H. Kauffman, MICH (see Bull. Soc. Myc. Fr. 55: 235. 1939). — *Tenn.* Cades Cove, Hesler 12889, FH. — *Ala.* Solita and Robinsons Springs, Burke 116, det. Singer FH. — *Fla.* Hogtown Creek, Newnans Lake, Gainesville, all in Alachua Co., Singer F 2186, F 2706 II, F 2361, F 2634, F 1973 a, F 2313, FH. — Highlands Co., Highlands Hammock State Park and Sebring, Singer F 475 a, F 13, F 127 and unnumbered specimens. — Dade Co., Matheson Hammock, Brickell's Hammock, Singer F 13 a, F 1339, F 1082, F 1268, FH. — *Calif.* Crescent City, A. H. Smith 8572, FH.

The differences between this and the preceding species were formerly considered as being of the varietal level. However, after further investigations, two facts came to light, first the redescription of *Russula consobrina* Fr. from Finland (Singer 1942, 1943) which shows that that species is undoubtedly strongly different from the remaining three and may even be inserted in the section *Decolorantes* rather than the *Ingratae* although certain basic similarities remain that make this decision rather difficult, second, the numerous notes on the various additional collections both in Europe and North America proved that the characters (even though they might be considered as not too impressive when taken separately) on which the distinction of the three remaining species rests, are all correlated and constant. It is easily possible to separate dried *R. pectinata* from the other two species because of the characteristic ornamentation of the spores. The distinction of *R. sororia* and *R. pectinatoides* is sometimes more precarious in dried material, but always clear in fresh material, or in material accompanied by good notes. Furthermore, basing our judgment on the definition of the subspecies term in mycology, we cannot find any supporting facts for the designation of subspecific status to *R. sororia, pectinatoides,* and *R. pectinata* whereby they might be considered as geographic races, mycoeco-

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types, or seasonal dimorphisms. Since they are definitely above the form level, they are now considered as autonomous species.

Some of the modern specialists of the genus *Russula* consider *R. pectinatoides* as the true *R. pectinata,* see comments on *R. pectinatoides.*

Russula lilacipes Shear, Mycologia **31**: 325. 1939.

This species has never been redescribed, and the author has nothing to add to a rather complete macroscopical diagnosis, but the microscopical redescription below will help to place the species in a modern classification:

Spores 6.5—7.8 ⇌ 4.8—6.5 μ, orn. 0.1—0.2 μ, of type VI—VII; basidia collapsed; cystidia numerous especially at the subheteromorphous edges of the lamellae, acute or with phantastically shaped appendages, e. gr. 78 ⇌ 7 μ, "empty" in most cases but perhaps with bluing (in SV) contents when fresher; hymenophoral trama near edge regular with filamentous hyphae, but farther back, towards the flesh of the pileus with numerous spherocysts but these being rather small and crowded together, and rarely isolated and globose as in in the higher Russulas; hymenopodium consisting of hyphae running parallel with those of the hymenophoral trama, in looser arrangement and more branched than in the latter; epicutis of the pileus loosely arranged, consisting of ordinary filamentous hyphae, imbedded in a mucilaginous mass, septate without clamp connections; some oleiferous hyphae with banded to granular contents also present in the cuticle; as well likewise in both hymenopodium and hymenophoral trama; gloeovessels seen in the cuticle which are now brown, but turn deep blue in cresyl blue mounts, running horizontally and being interwoven with the oleiferous hyphae and the "empty" ordinary filamentous hyphae; hypodermium differentiated from the epicutis merely by a denser arrangement of the elements; the brown dots of the stipe formed by hyphae and bunches of fasciculate versiform hyphal ends which are most frequently subcylindric, clavate or fusiform, melleous-fulvous with an incrusting, resinous (?) pigment; there is otherwise no well defined surface layer on the stipe, the heteromerous context reaching the very surface around the brown dots.

Material studied: *Va.* Arlington Cemetery, Shear 4058, marked type, but probably a syntype.

The data given above in connection with those published by Shear indicate that this is a remarkable species because of its bright colored stipe and viscid pileus. It seems to have some characters of the *Plorantes* where we were first tempted to insert this species, but considering the sum of characters exhibited by *R.*

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lilacipes, it appears preferable to consider it as a species of the *Ingratae*, probably relatively closest to *R. ventricosipes*, a rare species, redescribed from ample material from Massachusetts by the author in Type Studies I.

Section *Rigidae* Fr.

Subsection *Cyanoxanthinae* Sing.

Russula cyanoxantha var. *variata* (Bann.) Sing., Fedde Rep. Spec. nov. veg. **33**: 350. 1934.

Syn.: *Russula variata* Banning, Botan. Gazette **5** (2): 166. 1880 (1881).
Russula simulans Burl., Mycologia **13**: 129. 1921.

Pileus a smoky deep olive gray near "light grayish olive" with some (usually more in the outer half or on the extreme margin) "vinaceous fawn" or "fawn" or "light vinaceous fawn" in places, sometimes so colored on the disc, often mixed with "Kronberg's green", in age often "dark citrine", generally more purple vinaceous in youth and more green in age (the purple and green extremes being well represented in Burlingham, Mycologia 13, pl. 7, 1921), more rarely brighter and more yellowish green than indicated above or with pale isabelline or grayish discolorations, much like the colors of the typical *R. cyanoxantha* var. *cyanoxantha*, glabrous and viscid or more often subviscid when wet, after rains, but usually seen with very finely areolate or verruculose spots or silky to mealy-crustose surface and dry, usually slightly veined-subrugulose, with somewhat (over one quarter to one half) separable pellicle when fresh, with smooth, eventually often very short sulcate margin which is initially subinvolute and always acute, 55—90 mm. broad, more rarely even broader. — Lamellae pure white or sometimes between white and "cartridge buff" (R.), nearer to white, unchanging or more rarely changing to a light brown when bruised, not brittle, rather soft and almost waxy to the touch, rather narrow, 1—4 mm. broad, but eventually somewhat broader, sickle shaped, eventually often plane and descending, very frequently forked, sometimes forked at half-breadth of lamellae and therefore appearing intermixed with lamellulae which, like the forked lamellae, are frequently characteristically alternating in a regular pattern as in the *Compactae*, sometimes some true lamellulae present in addition to the forked ones, and more rarely, these also alternating regularly with the through-lamellae, subdecurrent, or deeply decurrent, often separating from the stipe because of their structure which is different from that of the stipe trama, little or not anastomosing, crowded, later close; spore print A, rarely A—B, nearer A (Crawshay). — Stipe white, subrugulose, solid, then becoming spongy and hollow, often with narrowed base,

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32—60 ⇌ 6—18, more rarely more voluminous. — Context white, concolorous with the surface under the pellicle or white all through, unchanging, firm and elastic when young, in age becoming subfragile; taste more or less acrid, more so in youth, often mild when old; odor none.

Spores 8—12 ⇌ 7—9.5 μ, mostly 8.2—11.5 ⇌ 7.2—9.5 μ, orn. 0.2—1 μ, of type IV, V, VI, very rarely IX, very frequently all VI in Florida and Alabama, and all V or IV in Europe, mostly projecting 0.4—0.8 μ; basidia 42—62 ⇌ 9—10.2 μ, 4-spored but in some collections (Fla.) often with 2- and 3-spored ones intermixed; macrocystidia 55—82 ⇌ 4.8—8.4 μ, numerous, mostly obtuse, versiform, with banded contents, bluing in SV, more rarely with granular contents and also bluing; edge subheteromorphous because of larger number of cystidia there than on the sides of the lamellae; trama predominantly filamentous in the lamellae but with rather more numerous spherocysts than in *R. cyanoxantha* var. *cyanoxantha*; epicutis of pileus with hyphal ends which are repent or ascendant, obtuse, some transformed into "hair-like" (cystidioid) bodies with larger diameter, the ordinary hyphae 2.5—3 μ thick, the cystidioid hyphal ends sometimes with crowded septa, some fusoid and then appearing to be dermatopseudocystidia with or without banded contents, bluing in SV sparingly and not consistently, up to 60 ⇌ 7.5 μ, but mostly smaller; hypodermium more consistently with cutis-structure, the hyphae somewhat interwoven but clearly tangentially arranged, dense, colorless in HN_4OH or almost so, with some inflated bodies in its lower portion (as in some Corticia and Clitocybes) and thus gradually transient toward the pileus trama in the central region, without clamp connections and without any sign of Virescens structure in the cuticle, including the crustose areas of the epicutis.

$FeSO_4$ on context of stipe negative, or very slightly and very slowly greenish gray in some collections, especially on old wounds. — Chlorovanillin negative or slightly orange to brownish on dried context but in fresh context negative. — Metol strongly and rapidly positive (deep purple violet).

On the ground in woods of broad-leaved trees and conifers, also in mixed woods under *Quercus* and *Fagus,* more rarely under *Picea,* in Florida in various hammocks, often in large groups, sometimes solitary.

Material studied: Europe: Austria, Schottenwald, Wiener Wald, T. Cernohorsky & Singer, W. — Ober-Weidlingbach and near Hintersdorf, Singer, W. — *Vt.,* type of *R. simulans,* Herb. Kelly 565 MICH. — *Mass.* Purgatory Swamp, Singer FH. — *N.Y.:* Huntington Forest near Newcomb, Singer, FH. — Type (?) and authentic material of *R. variata,* det. or confirm. Peck, NYS. — *Va.* Moun-

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tain Lake Biological Station Singer FH. — *Ala.:* Robinsons Springs, Burke 90, FH. — *Fla.*: Sugarfoot Hammock, Alachua Co., Singer F 2593, FH. — Highlands Hammock State Park, Highlands Co., F 437. — *Mich.* Several collections in the herbarium MICH. — Tahquamenon Falls State Park, Luce Co., Singer N 1017 MICH, F.

A smaller form was found in Michigan in summer 1953 which was tentatively labeled *R. cyanoxantha* var. *variata* forma *minima.* It had pale amethyst colored pileus with green pigment intermixed and was pruinate. The lamellae were regularly forked, the stipe white. Very few dermatopseudocystidia were observed in the epicutis of the pileus and also on the surface of the stipe. The $FeSO_4$ reaction was negative. The taste was acrid. The diameter of the pileus was 28 mm. and the stipe was only 20×8 mm. This may be an exceptional form due to the dry conditions of the season at this time (Tahquamenon Falls State Park, Luce Co., July 25, 1953, Singer 794, MICH, F).

This variety is one of the commonest Russulas of the North America continent, as common, or more so at places, than *Russula cyanoxantha* var. *cyanoxantha* in Europe. The situation is exactly reversed in Europe and in North America; in Europe, the acrid form is rare, and in North America, the mild form is rare. In view of this geographical distribution, it is impossible, at one hand, to call one or the other of these forms geographical races in the accepted meaning of the term, and, on the other hand, it is impossible to accept J. Schäffer's view who insisted that the acrid *R. cyanoxantha* was merely an unimportant "forma" implying that the character was never hereditary. Why, then, under such a variety of weather conditions and an even more impressive variety of climatic conditions (Vermont to Florida) this predominance of the acrid form in North America? Under the circumstances, we think it wisest and most adapted to our present knowledge of the situation, to continue the use of the varietal status for the acrid form.

Russula cyanoxantha var. *cyanoxantha.*

Syn.: *Russula cyanoxantha* (Schaeff. ex. Secr.) Fr. Monographia **2**: 194. 1863.

Agaricus cyanoxanthus Schaeffer ex Secr., Mycographie Suisse **1**: 509. 1833.

Agaricus viridescens Krombholz, Naturgetr. Abb. Schw. 8, pl. 67, 12—15. (*nom. subnudum*), 1845.

?*Russula furcata* (Lam. ex Fr.) Pers. ex Fr. Epicr. p. 352. 1838.

?*Amanita furcata* Lam. (pre-Friesian).

?*Agaricus furcatus* (Lam.) Fr., Syst. Mycol. **1**: 59. 1821.

Russula angustata (Pers. ex Secr.) Anonymus, Grevillea **20**: 73. 1892.

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Agaricus angustatus Pers. ex Secr., Myc. Suisse **1**: 512. 1833.
Russula aeruginescens Peck, Bull. N. Y. Sata Mus. **25**: 843. 1900.
Agaricus furcatus var. *heterophyllus* Fr., Syst. Mycol. **1**: 243. 1821.
Russula variata and *R. simulans,* see above (under var. *variata*).

The type variety has been described repeatedly and correctly in European monographs so that there is no need for a redescription. The American specimens agree closely to the European descriptions, but are rarely encountered (except perhaps in the Pacific Coast States). A collection from Michigan is obviously this and not var. *variata,* and refers to what we have distinguished as f. *lilacina* Britz. Botan. Centralbl. **68**: 138. 1896. The Western collections seen thus far refer to the typical form which is bicolorous (green or olive with lilac). The stipes are either white or with a lilaceous flush. In the Michigan collection, we observed an unusal $FeSO_4$ reaction, but this was still n e a r l y negative (a very pale and very tardy reaction not to greenish gray but to pinkish-grayish in the rind of the stipe, eventually pale grayish greenish inside).

Material studied: Numerous collections from Europe, especially from Germany, e. gr. Lonau, Harz, Schaeffer Russ. no. 11, FH, France, Switzerland, Austria, Czechoslovakia and Spain (Salardú, Catalunya, Bosc de Baricauba, Portilló, etc. BC). — North America: *Mich.* West of Pellston Airfield, Emmet Co., S i n g e r, N 561, MICH, F. — *Oregon:* Waupinita summit, Cascades, A. H. S m i t h 19094, 19154, FH. The type of *R. aeruginascens* may also be this (or var. *variata*), NYS.

R u s s u l a h e t e r o s p o r a Beardslee, Mycologia **26**: 259. 1934.

Pileus in the colors of *Russula cyanoxantha* var. *cyanoxantha* and var. *variata,* or more exclusively green "olive yellow", "olive ocher", "ecru olive" (R.), later becoming paler and assuming the colors of *R. aeruginea,* or even frequently bleaching to sordid alutaceous pallid or pallid, glabrous, subviscid, but in dry condition minutely scurfy-rivulose like *Russula crustosa* (but usually less distinctly so) or minutely rugulose-venulose as *R. cyanoxantha,* often somewhat cracking in the center, with half-separable pellicle, with subacute (90°) or acute smooth or somewhat tuberculate-sulcate margin, subglobose, then convex, usually early depressed in the center, eventually becoming concave to deeply infundibuliform, 56 —87 mm. broad, — Lamellae white, then pallid with a slight creamy shade, unchanging, soft and subceraceous but frequently less so than *R. cyanoxantha,* arcuate to plane, attenuate-decurrent or attenuate-subfree with small decurrent tooth or with decurrent ridges on the extreme apex of the stipe, anastosoming or not, narrow to rather broad (5—10 mm.), broadest either in the middle or in the outer

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third, close to more rarely medium close, frequently and almost regularly forked, equal or with few lamellulae, spore print white, A or in some collections between A and B but never reaching B (Crawshay). — Stipe white, varying from smooth to rugulose, solid, then stuffed or hollow, equal, or tapering upward or downward, 22 —46 ⇌ 11—23 mm. — Context white, unchanging, sometimes, in very old specimens, brownish in the pileus and in the base of the stipe, firm, becoming brittle; taste mild with sometimes a slight mawkish by-taste and often somewhat acrid in young fresh specimens, but at maturity completely mild; odor none or very weak (fruity, eventually of bread).

Spores ellipsoid, some ovoid-oblong, some almost subcylindric, 8—13.5 ⇌ 3.6—8.3 μ, usually about 9—11 ⇌ 5—5.5 μ, i. e. with an average Q (length/breadth) equalling 2, with suprahilar applanation when seen in profile, with an ellipsoid oil droplet, asymmetric, hyaline, minutely rough when seen in ammonia mounts under oil immersion, orn. up to 0.3 μ, of type IV, IV—VII, more rarely III b, III b—VII, V, VI; basidia rising from the uppermost layer of the subhymenium, 36—47 ⇌ 8.2—10.8 μ, clavate and rather elongate, 4-spored; pseudocystidia rising from the lower portion of the subhymenium, with yellow banded contents in the upper portion or almost all over, bluing in SV, or with hyaline granular contents in the lower portion, some without any contents at all, more often rounded than subacute at the apex, some with button-shaped appendage, usually fusoid-ventricose but also cylindrical or clavate, 35—71 ⇌ 4.7—10.3 μ; edge of lamellae slightly subheteromorphous because of the larger number of pseudocystidia there than on the sides of the lamellae; subhymenium a rather thick layer, consisting of extremely irregular rather small elements which appear to be subisodiametric in a cross section of the lamellae; hymenopodium none or obliterated; hymenophoral trama consisting predominantly of spherocysts but many of these very small or elongated, filamentous hyphae also abundant, some oleiferous hyphae present; epicutis of pileus a cutis, consisting of very thin horizontal filamentous (1—4 μ in diameter) hyphae which are often wavy and moderately dense in a layer of mucilaginous masses; below that, the pigmented and rather thick layer of the hypodermium little differentiated from the epicutis, except for being somewhat denser and, in its lower stratum, intermixed with very scattered small vesiculose bodies, pigment intracellular and dissolved, pale melleous greenish (dried material in NH_4OH); oleiferous hyphae present in both the hypodermium and the epicutis but scattered, not projecting and inconspicuous; dermatopseudocystidia none, only a few hyphal ends clavate but "empty", even in the acrid specimens; clamp connections none.

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$FeSO_4$ gray and salmoneous (side by side or overlapping to form the "normal" reaction) but olive in old stipe bases, more drab in the interior of the stipe after a while (so in F 2850) — Phenol chocolate. — Anilin on lamellae sulfur yellow around the drop. — NH_4OH and HNO_3 negative everywhere, — KOH on surface of pileus olive (observed once).

On the ground under *Quercus laurifolia* and *Q. virginiana* on lawns, etc., also near *Quercus minima* in flatwoods (*Pinetum palustris*), fruiting from May until September, Northern and Central Florida.

Material studied: Alachua Co., Gainesville, Murrill, confirm. Beardslee (authentic), F 15990, FLAS. — Ibid., Murrill, F 18444, FLAS. — Ibid. Singer, F 2207, FH. — Ibid. Singer, F 2762, FH. — Sugarfoot Hammock, Murrill (as *R. westii*), F 17387, FLAS. — Seminole Co., Longwood, Beardslee, comm. Burlingham, authentic, MICH. — Other collections were reported (labels without specimens) by Murrill in Clay Co., Putnam Co., and Marion Co.

Since not all collections included young and fresh material, it is impossible to state that all young and fresh specimens are acrid. This character was not mentioned in Beardslee's original account and it may be that some populations do not contain acrid specimens. If so, there would be some analogy between this species and *R. cyanoxantha*. In our mild collections, the pileus was green only whereas in our acrid collections there were purple tinges present. This is hardly a constant relationship, however, since Beardslee's original material had purple shades and mild taste unless the observation was incorrect. At any rate, the acrid taste is at best very weak. The ferrous sulfate reaction is in this species remarkably inconstant, but there is no correlation with the taste or the color of the pileus. Further observations on the occurrence of the three characters in definite relations would be of interest since it is possible that varieties can be distinguished on this basis if positive results should be obtained.

Subsection *Lividinae* Melz. & Zv.

Russula vesca Fr., Epicrisis p. 352, 1938.

Good descriptions of this species have been published in European monographs, and no redescription of American material is necessary. The species occurs in North America although, at least in certain years, it is much less common than *Russula brunneola*.

Material studied: *Pa.* Goshen Twp., Clearfield Co., L. K. Henry 3544. — also various collections from Maine and New Hampshire, northern Michigan. Innumerable collections from Europe.

This species is quite different from *R. flocculosa* Burl. and *R. brunneola* Burl. Both these species had been suspected of being synonyms of *R. vesca*.

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Subsection **Modestinae** Sing. subsect. nov.

Pileo subvelutino vel pruinoso, glabrescente, margine acuto vel subacuto, colore viridescente, purpurascente-lilacino, brunneolo-porphyrio, brunneo-subolivascente, etc. gaudente; epicute ex dermatocystidiis ciliatis consistente, cellulis basalibus dermatocystidiorum saepe incrassatis, cellulis criniformibus terminalibus saepe sulfovanillinicae reactionis ope caerulescentibus; sporis in massa albis vel cremeis (A vel C, Crawshayi); species typica: *R. modesta* Peck.

There is a group of species which is intermediate between the subsection *Lividinae* and subsections *Griseinae* and *Amoeninae*. They differ from the latter in having bluing elements in the epicutis of the pileus, but have, on the other hand the same (or a similar) subcuticular layer of swollen basal elements underneath the ciliate dermatocystidia which are morphologically quite the same as those of subsection *Lividinae* but differ, in certain cells, chemically. This new subsection is undoubtedly closest to subsection *Griseinae* from which it is not always clearly different, yet a line may be drawn by assigning all the white-spored (A) species to subsection *Modestinae*, and leaving those cream spored species in *Griseinae* which do not show the swollen subcuticular elements. Thus, *R. modesta* becomes the only species with other than pure white spore print admitted in the new subsection, and this for two reasons: 1) *R. modesta* is not too closely related with the other species of the *Griseinae* because of the structure of the epicutis of the pileus; 2) *R. modesta* is most closely related to *R. leucomodesta* Sing., a species differing from *R. modesta* mainly in pure white spore print. The *Virescentinae* which have much more regularly arranged and stronger inflated subcuticular elements than either the *Amoeninae* or the *Modestinae*, differ from the latter in the absence of bluing elements in the epicutis.

Russula brunneola Burl., N. Amer. Flora **9**: 233. 1915.

Pileus in dry weather a dusky porphyry brown to deep brownish purple ("cocoa", "coromandel", with some "tanbark" and "Java", or "Cordova" to "picadilly", "Hindu", "falcon", "kaffa", "Montella", "Van Dyke br.", between "cocoa br." and "Montella", or nearly black shading into "rose ebony" or "sphinx"), often on one side pallid to yellowish white (p. 9 E 1, M & P), in wet weather losing the purple brown component of its pigment, and assuming a dull fuscous to fuscous olive color, the former often reminding one of *R. consobrina* Fr. ("yellow beige" with "clove" shades, "brown sugar", "Mandalay" in center, or "beech") and pl. 15 L 9 mixed, with pallid center, at times nearer to the color of *R. vesca*, especially in older specimens, e. gr. "tanagra" with the center pl. 8 L 3, (M &P), smooth (not veined-rugulose as *R. vesca*), pruinose but after rains glabrescent, at least

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on one side of mature caps with more or less strongly sulcate-pectinate margin, with a cuticle separable over 2/3 of the radius, with acute, eventually often subobtuse margin, convex, then repand and eventually often flattened to subconcave, often with depressed center while marginal zone still remaining convex, 60—115 mm. broad. — Lamellae white, with a slight yellowish reflex, rather flexible but not as much as *R. cyanoxantha* (although almost as much as *R. heterospora*), attenuate-subfree, or adnexed, anastomosing, some forked or bifurcate at the stipe, equal or subequal, about 5.5—9 mm. broad, close or subclose; spore print white, A (Crawshay) or very slightly off A, never reaching B. — Stipe white, but very frequently with a dusky violet brown shade, often with a "blonde" tinge (M & P), not rarely with some rusty spots, rugulose, solid, spongy to spongy-hollow in age, tapering downward or subequal to somewhat ventricose, 25—110 ⇌ 12—38 mm. — Context white, sometimes somewhat olive immediately under the cuticle, unchanging; taste mild; odor none.

Spores hyaline, size of *vesca*-spores, orn. rather low, type IV; basidia and pseudocystidia as in *R. vesca,* the pseudocystidia at the tip or downwards to one half of their length blue granular in SV, fusoid, moderately numerous; epicutis of the pileus formed by a trichodermial palisade consisting of ciliate dermatocystidia which do not turn blue in SV although some branches of the palisade are always transformed into obtuse or acute pseudocystidial cells (elongate, often cylindrical, 3—5,5 μ in diameter) with scattered blue granulose contents or entirely blue in SV, the non-bluing branches attenuate or acute, septate above a thicker and shorter basal cell, often with constrictions toward the apex; on surface of stipe some hyphae locally swollen or with cystidioid terminal bodies with in SV bluing contents and 2.7—4,5 μ in diameter, rarely broader, often long and laticiferoid, otherwise with a structure similar to that of the epicutis of the pileus; all hyphae without clamp connections.

$FeSO_4$ on context of stipe immediately "salmon", "musk melon", pl. 4 A 11 to salmon vinaceous "Mexico" to "Formosa" (M & P). — Phenol: chocolate on context. — KOH in the brown or olive brown specimens staining yellowish green ("bister green" to pl. 20 L 1, M & P), in the others "tennis" (not green).

This species is difficult to distinguish from *R. vesca* only in cases where the color of the pileus coincides with that of the latter species and then only in dried material since the SV reaction with some of the ciliate dermatocystidia of the epicutis permits an immediate separation.

It grows on the ground, predominantly in mixed woods (*Tsuga, Populus, Betula*) or under *Fagus* and *Picea,* often in large groups,

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fruiting in June and continuing until August and probably also later. Vermont and west to Michigan.

Material studied: *Vt.*, C. D. Doravin, det. Burlingham, Herb. Boston Myc. Club, FH. — *Mich.:* Douglas Lake to north shore of Burt Lake, Cheboygan Co., Singer, N 598, N 635. — Mackinaw Hardwoods to Wilderness Park, Emmet Co., Singer, N 698, N 815, N 816, N 819, N 824, N 826, N 1064. — Tahquamenon Falls State Park, Luce Co., Singer, N 761; all Mich. collections at MICH, F.

A "*cutefracta*" form which varies from slightly punctate-pustulate to crustose-flocculose on the margin to outright rimose-lacerate all over, was also collected but seems hardly more than a meteorological variation, N 698, N 826.

A painting is preserved at the University of Michigan.

Russula leucomodesta Sing. spec. nov.

Pileo viridi, centro alutaceo-pallido, venoso, glabro, margine sulcato acuto instructo, 46—48 mm. lato. — Lamellis albis, subdecurrentibus, distantibus, haud ventricosis; sporis in cumulo candidis. — Stipite viridi-granulato, subaequali, 38—47 ⇌ 12—13 mm. — Carne alba, miti, subinodora. — Sporis 8.2—9.2 ⇌ 6.8—7.8 μ, echinulatis; cystidiis biformibus; epicute pilei dermatopseudocystidiis gaudente, cum dermatocystidiis ciliatis contentu carentibus et dermatocystidiis ciliatis cotento farctis interspersis; dermatopseudocystidiis in stipite praesentibus. — Sub quercubus, Newnan Lake, Alachua Co., Florida, typus.

Pileus "leaf green", "dusky olive green" (R.), on the disc buffy pallid, venose, glabrous, with acute to subacute (about 90° maximum) sulcate margin, convex with depressed center, eventually irregularly applanate, 46—48 mm. broad. — Lamellae white with a very slight creamy tinge when adult, subdecurrent, distant, with some lamellulae intermixed, with occasionally a few forked ones, 4 mm. broad, not ventricose, occasionally rather subdistant than distant; spore print A (Crawshay). — Stipe white with a pale green granulation (color of the pileus but diluted because of the small size of the granules on white background) over most of the surface, subequal, 38—47 ⇌ 12—13 mm. — Context white, unchanging; taste mild; odor none or slightly of fish (like odor of *Tylopilus tabacinus*).

Spores 8.2—9.2 ⇌ 6.8—7.8 μ, subglobose, hyaline, orn. 0.7—1.5 μ, mostly 1 μ, of type VI exclusively; basidia 28—32 ⇌ 7.5—9.3 μ, the longer, the narrower, clavate-ventricose, 4-spored; cystidia in two forms, 1) shorter and more voluminous with plenty of banded or subgranular yellowish-melleous contents, with the aspect of gloeocystidia, broadly rounded above, 9.8—13.7 μ broad, 2) longer 37 μ or more μ long and 10—10.5 μ broad, with or without a granular zone

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at the apex (as in *R. nauseosa*), attenuate toward the tip; epicutis of pileus with ciliate dermatocystidia which are much like those of *R. modesta* but perhaps in an average with more elongate preterminal members and blunter tips, some of them filled with the same kind of contents as observed in the dermatopseudocystidia which occur among the ciliate dermatocystidia and have conspicuous banded to granular contents, rounded tips, a diameter of 4.3—8.5 μ and are ventricose to clavate; surface of stipe with ventricose-fusoid-mucronate ciliate dermatocystidia, corresponding to those in the epicutis of the pileus but apparently constant in their shape, with or without banded, more rarely granular contents, very numerous, aside from these there are also ascendant hyphal ends which contain a pale, intracellular, dissolved pigment (greenish).

$FeSO_4$ on context of stipe sordid gray, with some pale red and olive areas. — Phenol on context of stipe drab then chocolate, eventually black in old specimens.

Under oaks on the ground on sandy soil, Northern Florida.

Newnans Lake, Alachua Co., Fla., July 23, 1943, R. Singer, F 2916, FH, type.

Macroscopically, this species suggests immediately *Russula glaucescentipes* Murr. described from the same county, but the type has no dermatopseudocystidia, and a specimen corresponding to the type was collected by this author, and found to different from *R. modesta* (see below).

Russula modesta Peck, Bull. N. Y. State Mus. **116**: 78. 1907.

Pileus some kind of green or olive gray ("leaf green", "Russian green", "tea green", "andover green", "buffy citrine", "deep olive buff", "dark olive gray", "olive gray", reaching "deep mouse gray" and "deep neutral gray" in some caps or as deep as "dark ivy green" in the center where it often fades to pallid, "buffy olive", or "chamois", R.), often especially in young specimens, partly (either in the center or on the margin) lilac tinted ("light grayish vinaceous", "pale grayish vinaceous", "cinnamon drab", "light cinnamon drab" R.) but this color either fading or disappearing somehow and replaced by an "avellaneous" (R.) tinge, often with paler or sordid spots here and there, with a slight bloom, smooth, often faintly rivulose or cracked in the manner of *R. crustosa* but with smaller areolae and mostly over limited areas, sometimes subrugulose in the center, with smooth margin, later becoming sulcate or even plicate on the margin or remaining smooth in other specimens, with subacute, eventually obtuse margin which scarcely ever becomes rounded in age, with dry (not viscid) and never distinctly shining surface, with the cuticle separable part way to the center, convex, then depressed in the cen-

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ter, eventually concave, 30—92 mm. broad. — Lamellae white, then cremeous to orange pallid, equal or with a few shorter ones intermixed, varying from simple to bifurcate at the stipe, or with many forked ones intermixed, but not in a regular manner as in *R. cyanoxantha,* flexible as in *R. heterospora* to quite brittle, often separating from the stipe, attenuate and attingent-subfree or adnexed to eventually adnate-subdecurrent, narrow to broad, 5—12 mm. broad, broadest in the marginal third, subclose to close, but neither crowded nor subdistant to distant; spore print pale cream, B (Crawshay) in intensity, but often with a more salmon tone. — Stipe white, rarely pure white all over, ordinarily tending to become partly glaucous or grayish or with a faint lilaceous tinge, rarely entirely concolorous with the pileus, smooth, soon becoming subrugulose or rugulose, solid or stuffed, sometimes with some cavities in age, or becoming hollow, often comparatively thick, tapering downwards, or equal to subequal or subventricose, sometimes pinched off at the base, in dried condition usually distinctly off white, 30—60 ⇌ 8.5—22 mm. — Context white everywhere, including the subhypodermial zone, rarely olive gray under the cuticle, unchanging; taste mild; odor none, rarely very weakly of creme Chantilly, or of iodoform, not developing a sweat odor on drying.

Spores 6.2—9.1 ⇌ 5—7.5 μ, rarely reaching larger sizes if 2-spored basidia are present, and then up to 9.5 ⇌ 6.5 μ, ellipsoid, otherwise rarely over 9 μ long and subglobose to short ellipsoid, orn. 0.2—0.9 μ, of type VI, V, IV, III b, some with IV—II or III b—II or III b—VIII rows, especially where III b spores dominate as in young or retarded specimens, while spores taken from a good print always have more isolated warts, the connecting lines, where present, fine to extremely fine; basidia 28—53 ⇌ 7.5—11.5 μ, either all 4-spored, or with a variable number of 2-spored ones intermixed; cystidioles at or near the edge often present, e. gr. 38 ⇌ 7.5 μ; macrocystidia fusoid or ventricose, acute or more rarely rounded at the apex, sometimes somewhat constricted at the apex, appendiculate or not, 34—84 ⇌ 6.7—14 μ, deep blue in SV at least in the upper portion, with abundant banded contents, numerous at the edge, less so on sides of lamellae (edge subheteromorphous); epicutis of pileus consisting of a cutis of filamentous hyphae (possibly originally a trichodermium?), imbedded in a gelatinous mass, in the upper portion numerous ciliate dermatocystidia present, continuing a "subcuticular" stratum of 0—4 short elements (7 ⇌ 7 μ to 13—20 ⇌ 6.2—12 μ), the cystidioid ends themselves subulate and more or less acute in most cases, 22—90 ⇌ 3.5—8.8 μ; hypodermium a cutis of filamentous slightly pigmented (mostly pale yellowish greenish in dried material) subparallel-interwoven hyphae; both in cuticle and on the surface of

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the stipe also more or less numerous dermatopseudocystidia but in many collections, these are not otherwise differentiated than by the SV reaction (blue) and might morphologically pass for ciliate dermatocystidia, while in other collections true macrocystidia also occur; ciliate dermatocystidia on the surface of the stipe also non-bluing (the non-bluing type likewise numerous there); the true dermatopseudocystidia of the macrocystidial type, where present, in both pileus and stipe 52—90 ⇌ 4.8—10 μ.

$FeSO_4$ on context of stipe sordid pale gray or sometimes with pale salmon cortex and gray interior of the stipe. — Phenol with context of stipe becoming "fawn color" R., then becoming normal (chocolate), or directly (but slowly) chocolate. — Metol with context giving a slow positive (violet-lilac) reaction. — KOH on cuticle of pileus cinnamon.

Under *Quercus virginiana* and *Q. laurifolia,* rarely under *Pinus palustris* and *P. taeda,* on humus and among short grass in forests and on lawns, fruiting from May until November. New York to Florida.

Material studied: *N. Y.,* type NYS. — *N. C.* Flat Creek, Hesler & Smith, MICH, LE. — *Tenn.*: Grassy Patch, Hesler & Smith, MICH, LE. — *Fla.* Alachua Co., Gainesville, Singer, F 2024, F 2300, F 2772, F 2604, FH. — River Rise, Murrill (ut *R. subcyanoxantha* var. *olivacea*), F 8780, FLAS. — Manatee Co., Bradenton, C. B. Stifler (ut *R. aeruginea*), F 31378, FLAS. — Dade Co., South Miami, Singer, F 1120, FH.

This species is rather common in Florida, and generally in the South, but becomes gradually less common toward the North. Some collections from Michigan seem to belong here, but their descriptions are not included pending further investigations. *R. modesta* can come very close to some of the forms around *R. palumbina* Quél. It differs from *R. parazurea* J. Schaeffer in being mild even in young carpophores, and having different spores. *R. ferreri* has deeper spore print. Among the American species, *R. maxima* Burl. is a much stouter, typically Western species, and *R. ornaticeps* Burl. differs in colors (see below).

Subsection *Griseinae* J. Schäffer.

Russula ornaticeps Burl., Mycologia **13**: 130. 1921.

Pileus steel blue and lilac (either dotted in these colors, or margin more blue, or else more blue on one side and more lilac on the other): the blue corresponding to M & P pl. 40 H 4 or "Annapolis", the lilac pl. 45 G 1 or 44 I 1, very slightly veined, granular-subrivulose to very slightly pruinose, not very viscid or at least rapidly drying

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out, with the cuticle easily separable only in the outer two thirds or in the outer third of the pileus, never easily separable in the inner third of the margin when fresh and somewhat removed from the extreme margin leaving the flesh uncovered in old specimens, with obtuse to subacute, eventually rounded margin which is smooth at first and becomes later short-sulcate, convex, umbilicate, eventually convex-applanate with depressed center, 62—66 mm. broad. — Lamellae white, sinuate, anastomosing, with one to several lamellulae intermixed, often several forked, especially near the stipe, often with lilac edges near the margin of the pileus, moderately broad (5 mm.); spore print C (Crawshay). — Stipe white, partly with a faint hue of pink or purplish pink, in some cases pink or purplish pink all over (pl. 43 E—F 1, or paler, M &P), sometimes also partly steel blue like parts of the pileus, tapering downwards, 39—67 ⇌ 16—19 mm. — Context white, unchanging; taste mild; odor none.

Spores 7.3—8.4 ⇌ 6.7—7.7 μ, orn. up to 0.8 μ, of type IV, in some spores III b; macrocystidia moderately numerous, versiform, blue in SV; epicutis of pileus consisting of trichodermial palisade of ciliate dermatocystidia, among them also numerous dermatopseudocystidia which turn blue in SV; dermatopseudocystidia also numerous on the surface of the stipe.

$FeSO_4$ with the context of the stipe pale pinkish gray, slow and rather weak reaction, in rind of stipe and flesh of pileus strong and rapid grayish pink reaction. — Phenol: chocolate with context. — Sulfoformol everywhere negative.

In mixed frondose woods on the ground, often under or near *Fagus grandifolia,* or *Populus tremuloides,* usually solitary or in small groups. Fruiting in August.

Material studied: Canada, Indian Point region, Ont., Aug. 7, 1920, G. S. Burlingham, Kelly 805, MICH. — *Mich.*: Douglas Lake, Cheboygan Co., Singer, N 1086, MICH, F. — Nine Mile Point, Presque Isle Co., Singer, N 1234, MICH, F. — Tahquamenon Falls State Park, Luce Co., Singer, N 1295, MICH, F.

This species is close to *R. anatina* and *R. parazurea* from Europe, differing from both sufficiently. It is one of the species that can be identified comparatively easily in the field.

Subsection *Amoeninae* Sing.

Russula alachuana Murr., Mycologia **30**: 362. 1938.

Syn.: *Russula subcyanoxantha* Murr., Lloydia **6**: 217. 1943.
?*Russula subviridella* Murr., l. c. p. 217.
?*Russula amoena* Quél. var. *intermedia* Blum, Bull. Soc. Myc. Fr. **68**: 255. 1952.

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Pileus "deep purplish vinaceous", "madder brown", "sultana", "mauve rose", margin often paler (e. gr. "Etruscan red" or "orange vinaceous") often mixed with "tawny olive" (R.) or sordid cream to pallid areas, but the purple tinges coming out more distinctly on drying (as in the whole subsection), also pl. 8 I 4 (M & P), white pruinate to minutely granular, smooth with smooth margin which becomes more or less sulcate only in old material, with subacute, later obtuse or rounded margin, with the cuticle separable a short way from the margin, viscid only in rainy weather but drying out very rapidly, often giving a velvety impression, convex, then in the center depressed, eventually usually applanate or concave, 30—100 mm. broad. — Lamellae "cartridge buff" (R.) in side view, cream colored, corresponding to no. 8 (Crawshay), sometimes somewhat purple-lilac on the edges near the margin of the pileus, narrow to broad, with few to many forked ones intermixed, often with a good many bifurcate ones near the stipe, but equal or with only a few shorter ones intermixed, crowded or close (e. gr. 120 reaching stipe), usually more or less anastomosing, attenuate-adnate; spore print B, B—C, C (Crawshay), not deeper. — Stipe "light Congo pink", "Vernonia purple", under a lens minutely pink-granular, pruinose, also often white with only partially colored (as above) outside, the white portions white-pruinose, equal with or withhout attenuate base, solid, eventually stuffed to hollow, 20—56 ⇌ 8—20 mm. — Context white, unchanging; taste mild; odor of *Lactarius volemus* but weaker.

Spores 7.5—9.5 ⇌ 6.5—8.2 μ, rarely reaching 11 ⇌ 10.2 μ, orn. 0.5—1 μ, of type II, some III a; basidia 38—45 ⇌ 9—11.7 μ, ventricose-clavate, 4-spored; cystidia 75—120 ⇌ 6.5—20.5 μ, ventricose in the middle or in the upper third, attenuate above but rarely sharply acute, "empty", not bluing in SV; cheilocystidia crowded at the edges, similar to the pleurocystidia but usually somewhat smaller in an average and the broadest portion nearer to the base, long attenuate above with thin to occasionally thickened wall (up to 0.9 μ), 34—128 ⇌ 4.8—15 μ; subhymenium subcellular, becoming gradually less cellular farther away from the hymenium; hymenopodium at places indistinct, filamentous, very thin; hymenophoral trama mostly cellular with many filamentous (connective) hyphae intermixed; dermatocystidia of the pileus versiform, the majority much like the cheilo- and pleurocystidia, but some with constrictions, and septate, often with rounded tip, forming a palisade; dermatocystidia of the stipe 26—86 ⇌ 7.5—10 μ, much like the cheilocystidia, forming a palisade; hyphae without clamp connections.

In frondose woods and hammok, or in mixed woods under frondose trees (e g. *Pinus strobus* and *Ulmus americana*), also under *Tilia*, but most commonly under *Quercus*, from Massachusetts south

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to Florida and west to Washington, fruiting from April to October, in the West also in winter (January).

Material studied: *Mass.* Near Nurembega Park, Singer, FH. — Observatory Park, Singer, FH. — Lexington, Singer, FH. — Purgatory Swamp, Singer, FH. — Bridgewater, Linder, det. Singer, FH. — Yard of Harvard University, Darker, det. Singer, FH. — Wellesley, Mrs. Hall, ibid. Linder, det. Singer, FH. — *R.I.* Providence, J. Franklin Collins, det. Singer, FH. — *Pa.*: Near Armagh, Sumstine, det. Singer, FH. — *Ala.*: Robinsons Springs, Burke 155, FH;Fusihatchie, Burke 103, FH. — *Ohio*: Coshokton Co., L. J. King, det. Singer, no. 1319, F. — *Mich.*: Milford. A. H. Smith 10944, det. Singer, MICH. — *Tenn.* Elkmond, Linder, det. Singer, FH. — Husky Gap Trail, Great Smoky Mts., A. H. Smith 9756, MICH. — Fla., type of *R. alachuana*; type of *R. subcyanoxantha*, FLAS. — Gainesville, Alachua Co., Singer, F 1863/Ia, F 2125, FH. also observed in Highlands Hammock State Park. — *Wash.*: Marysville, Grant, 2 specimens, FH. — *Calif.*: Determined by Miss Morse as *R. drimeia*, January 14, 1934, probably this, FH.

This is the commonest representative of the subsection in America. It is the purple form observed everywhere in the Northeast, but reaching Florida and the Pacific Coast States, mingling in the South with other representatives of this group. This was currently called *R. mariae* Peck in the United States, and rightly so, because Peck himself did not distinguish this species from his original concept which is based on the following species. Murrill himself used to call *R. alachuana R. mariae*, but for some reason believed the Floridian collections (of what he called *R. alachuana* and *R. subcyanoxantha*) different from the northern ones which is in error. Whether his *R. subviridella* is a rare green form of *R. alachuana* cannot be established beyond doubt.

European writers, with the exception of this author, have jumped to the conclusion that the purple species in the *mariae*-complex is the same as *R. amoena* Quél., and some have gone so far as to synonymize the two species. In the first place, Peck's species does not refer to the purple forms described above. In the second place, in the light of Romagnesi's investigations on the European forms involved, it appears that *R. amoena* Quél. has much deeper spore color (D, F according to Romagnesi) while the form, better known to this author, with pale spore print, called *R. violeipes* by Romagnesi, is widely different macroscopically, and as it seems, also to a certain degree chemically. We have studied specimens of the true *R. amoena* (Algérie, La Reghaia, under *Quercus suber* Herbier Maire, FH.; Spain, Catalunya, La Cellera, Singer, BA.; France, Lyon, Parc, Schäffer, Russ. Exs.). The external appearence

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is very much that of *R. alachuana,* but I believe the species can be distinguished specifically. Even if Romagnesi were wrong in regard to the spore print color — which is an item not checked upon by the present author, but should not be doubted — *R. amoena* is the oldest name available for the European species since *R. mariae* differs strongly not only in the spore print but in the color of the pileus.

Russula mariae Peck, Ann. Rep. N. Y. State Mus. **24**: 74. 1872.

Pileus deep pinkish red ("troubadour r." to pl. 4 L 7), strongly scurfy and finely granular, sometimes covered with some atomaceous glaucous particles, pruinate but becoming viscid when quite wet, drying very rapidly, with half-separable cuticle, with subacute (90°) smooth margin which becomes eventually short-sulcate, convex, eventually depressed, with an intermediate subapplanate stage, 20—65 mm. broad. — Lamellae white, eventually sordid cream color, subclose, to crowded, tapering toward the stipe where they are adnate or sinuate-subfree, moderately broad to almost broad (2.5—5 mm.), broadest in outer third, equal or with 1—2 lamellulae; edge occasionally red; spore print between C and D, nearer D (fresh). — Stipe pink ("flirt" to "watermelon" M&P) or these colors mixed with white, pruinate, rugulose to subrugulose, solid then stuffed to hollow, equal, 24—30 ≒ 5—10 mm. or occasionally smaller. — Context white, unchanging, thin but rather firm at first; taste mild or (according to Kauffman) very slightly acrid *); odor of *Lactarius volemus,* but weak.

Spores 7.5—10≒6.7—8 µ, orn. of type II; basidia 38—40≒8.5—10 µ; cystidia ventricose below or subulate or ampullaceous, "empty", sometimes with globose basal cell; cheilocystidia similar, crowded; epicutis of pileus consisting of dermatocystidia which form a palisade and are much like the cheilocystidia, but more versiform, about 60—70 ≒ 6.5—7 µ, sometimes rosary-shaped with acute filiform apex, subulate, ampullaceous, pinshaped to spindle shaped, etc., usually acute, occasionally some spherocysts among them; macrocystidia absent in the carpophore; hymenophoral trama consisting of spherocysts (25—40 µ diameter), with numerous connective hyphae (2 µ diam.) intermixed, all hyphae without clamp connections.

Growing on dry and moist earth and among mosses in frondose woods, fruiting in summer, from New York south to Virginia and west to Michigan.

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*) We have always found this species mild, but since this observation comes from a very reliable source, accompanied by specimens which belong undoubtedly to this species, it is perhaps worth mentioning it.

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Material studied: *N.Y.*, type of *R. mariae,* NYS, FH (Ellis Herb.), from the Catskill Mts. — *Va.*: West Virginia Road, Giles Co., Singer V 399, FH. — *Mich.*, Elkmond, Kauffman(under herbarium name "R. aciculocystis"), det. Singer, MICH, LE.

This species is comparatively rarer than *R. alachuana* and has quite different colors which we find to be constant. Its area does not seem to extend as far south as that of *R. alachuana.* The spore print color is very slightly deeper than in *R. alachuana,* an additional correlated character.

Russula variegata Sing. spec. nov.

Pileo viridello-olivaceo, minute venosulo, margine fortiter tuberculato-sulcato, obtuso nec rotundato, 58 mm. cc. lato. — Lamellis pallide cremeis, distantibus, latis vel latissimis; sporis in cumulo D Crawshayi. — Stipite pallide livido ex granulis variegatis, subaequali, 30 ⇌ 9 mm. cc. — Carne alba, miti vel submiti, inodora. — Sporis 8.3—8.8 ⇌ 6—6.8 μ, reticulatis nec cristulatis; macrocystidiis praesentibus; epicute pilei ex cellulis cystidioideis, hyphis breviusculis catenulatis superimpositis, acutissimis vel acutiusculis, longissimis, subulatis, contentu amorpho vel granulari impletis vel contentu carentibus formata, vix macrocystidioideis. — Ad humum in silva mixta, Sugarfoot Hammock, Alachua Co., Florida, July 4, 1943, typus.

Pileus greenish-olive or green, minutely veined, with strongly tuberculate-sulcate obtuse (but not rounded) margin, convex, with depressed center, about 58 mm. broad. — Lamellae pale cream color, distant, broad to very broad (8.5 mm.), attenuate-subfree, broadest in the middle third, anastomosing, equal or with very few lamellulae intermixed, simple; spore print deep cream color, D (Crawshay). — Stipe on white ground densely pale livid granular because of (under a lens) pale greenish and pale lilac granules which make it bicolorous, subequal, 30⇌9 mm. or thereabouts. — Context white, unchanging; taste mild or submild; odor none.

Spores 8.3—8.8 ⇌ 6—6.8 μ, orn. 0.5—0.8 μ high, of type III b (some with short ridges II—IV, III b—II, very few IV—VIII, III b—VIII); basidia 40—46 ⇌ 8.2—9.3 μ, 4-spored; macrocystidia present, on the sides with abundant yellow banded-granular contents, on the edges with very scanty contents, irregularly appendiculate or non-appendiculate, acute, 65—102 ⇌ 8.8—10.2 μ; cheilocystidia inconspicuous, hyphous, sparse, near the margin of the pileus; epicutis of pileus consisting of cystidioid terminal cells which are sharply acute or subacute, very long, subulate, few of them incrusted, or else with amorphous or granular contents (SV reaction of fresh cystidia unknown), very frequently pyramidally convergent like the pegs of the *Corioli,* rising from a subcuticular layer of short catenulate elements.

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On humus in low hammock under pines and frondose trees, fruiting in July. North Florida.

Material studied: Sugarfoot Hammock, Alachua Co., Singer, F 2544, FH, type.

This species differs sharply from *R. alachuana* in the presence of macrocystidia on the sides of the lamellae, also in the much less ridged spore ornamentation. Unfortunately, there is no record of a sulfovanillin reaction in the epicutis. Although it is practically certain that the cystidioid bodies on the pileus are of the ciliate type and apparently transient to the primordial type, it is still barely possible that there is a weak SV reaction in some of the terminal cells such as has been observed in *R. brunneola*. In case this should be so, *R. variegata* is expected to be closest to *R. hibbardiae* Burl. Otherwise, there is no valid reason to remove it from the subsection *Amoeninae* even if the latter is maintained in a restricted sense. If it were not for the distinctly deeper colored spore print, one may be tempted to compare this with *R. leucomodesta*. It is also impossible to identify this species with *R. glaucescentipes* since the spore ornamentation and spore color are quite different.

Russula tuberculata Murr., Bull. Torr. Bot. Cl. **67**: 58. 1940.

Syn.: *Russula subincarnata* Murr., Mycologia **33**: 442. 1941.

Pileus pale greenish to olive and sometimes almost white on the margin and with pale incarnate-pink to blackish purple center, the two zones varying greatly in extension, and the greenish zone is occasionally entirely absent, the purplish zone varying strongly in intensity, sometimes both colors combined in patches and blotches even on the margin (then usually "Indian red" to "ocher red" R.), in the center "Mars violet" to "warm blackish brown", but occasionally lighter colored and frequently fading to much paler, very minutely punctate-areolate (usually only under a lens), slightly viscid when fresh, drying rather rapidly, cuticle peeling over one half of the radius, in paler specimens often peeling more readily and farther toward the center, with initially subacute, then obtuse but never rounded margin, or eventually with partly rounded margin, the latter soon strongly and conspicuously sulcate to sulcate-tuberculate, convex and mostly rather deeply umbilicate and eventually more or less depressed in the center, eventually often more flattened and concave, 50—67 mm. broad. — Lamellae cream colored when mature, often with purple or pink edges at the stipe or towards the margin of the pileus, medium distant to distant, anastomosing, broad, rarely narrow, usually about 6—8 mm. broad, more or less ventricose and broadest in the middle, equal, simple, or with few to many forked ones intermixed, attingent to adnexed, eventually often slightly decurrent, more

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rarely adnexed with decurrent tooth from the beginning; spore print varying from slightly deeper than B to slightly paler than C (Crawshay), with the tone quality nearer D, but much paler. — Stipe "jasper pink" or "old rose" (R.), only the base and often the apex white, nearly smooth, very finely granular or subpruinose or glabrous with short ribs running down from the lamellae over a distance of 1—3 mm., but not constantly so, solid, becoming spongy inside old specimens, subequal or tapering downwards, 30—54 ⇌ 9—14 mm. (rarely reaching 21 mm. in diameter). — Context white, with a tendency to become purplish rosy in wounds of the pileus and often conspicuously pink underneath the cuticle, tending to become brown on and in the stipe when dried, but unchanging in fresh material and in some well dried material, rather firm, later spongy-soft; taste mild, almost nutty; odor none.

Spores 8.8—13.3 ⇌ 7.5—12.2 μ (from spore print), orn. 1—2 μ projecting, of type II, rarely type I, III a, almost globose and seemingly symmetrical but hilar appendage strongly lateral, inserted away from the longitudinal axis of the spore and oblique; basidia 38—55 ⇌ 8.5—13.6 μ, subclavate-subventricose, broadest just below the apex, 4-spored; macrocystidia none; cheilocystidia making the edge of the lamellae heteromorphous, 48—80 ⇌ 6.8—10.2 μ, hyaline (or in very old dried material sometimes melleous), crowded, "empty", usually ventricose near the base and the upper portion long-subulate but the very tip more often rounded than acute, however always some shorter cheilocystidia present which are fusoid or ampullaceous (e. gr. 35 ⇌ 8.8 μ); subhymenium and trama as in *R. alachuana*; epicutis of pileus consisting of filamentous hyphae, terminating in the upper stratum in a palisade (often appressed by raindrops) made up of chains of short elements, some of them sometimes spherocysts and then approaching the structure of *R. virescens,* with the terminal member being versiform (constricted in the middle, long-pilose, more often the latter, and then 23—75 ⇌ 5.3—8 μ, otherwise e. gr. 18.5 ⇌ 8.2 μ; this palisade often loosely arranged and fragmentary and then all terminal members present — cystidioid; hypodermium yellowish to melleous-yellow, forming a cutis of filamentous hyphae, all wavy-subinterwoven and more or less imbedded in a gelatinous mass (as in the lower portion of the epicutis), but rather dense, nevertheless, hyphae without clamp connections.

$FeSO_4$ on context of stipe melleous-sordid, in cortex of stipe sordid pale reddish. — Phenol on context "vinaceous lilac" R. — KOH on pileus bright rufous orange. — HNO_3 on pileus: paler.

Usually in small to large groups in flatwoods under *Pinus palustris* along grassy or sandy roadsides, often associated with *Amanita mutabilis,* fruiting from June until September in Florida.

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Material studied: Alachua Co., Sugarfoot Hammock, Murrill, FLAS, type of *R. tuberculata.* — Gainesville, Murrill F 16448, FLAS, type of *R. subincarnata.* — Sugarfoot Hammock, Singer F 2602, FH, topotype. — Newnans Lake, Singer F 2640, FH. — Highlands Co., Highlands Hammock State Park, Singer F 151, FH.

This species, undoubtedly a typical representative of the subsection *Amoeninae,* is well characterized not by the notes indicated by Murrill but by the strongly projecting (mostly between 1.3 and 1.6 μ) ornamentation and the size of the spores. This is a characteristic species for the flatwood mycoflora and seems to form mycorrhiza exclusively with *Pinus palustris.*

Russula variicolor Murr., Lloydia **6**: 219. 1943.

Pileus "purple drab" with some "slate violet" and "rhodonite pink" or pallid areas, also "vernonia purple", "Daphne red", "rocellin purple", sometimes much paler than both *R. alachuana* and young *R. tuberculata,* velutinous to glabrous, often somewhat velutinous-granular at places, smooth even on the margin which is obtuse, with slighlty viscid pellicle when very wet, but drying very rapidly, separable part way to the center which is depressed while the marginal portion remains convex, entirely depressed or applanate when old, 40—87 mm. broad. — Lamellae white, then slowly becoming cream colored, rather flexible, more so than in the average *Russula* but less so than in *R. cyanoxantha,* anastomosing, subequal to intermixed, often forked near the stipe, adnate, subdecurrent, sometimes decurrent, subarcuate, medium broad (6 mm.) to broad (10 mm.); spore print between D and F, but in the herbarium fading to C or D (tone of D), (Crawshay). — Stipe white, often with some rosy-red portions, subpruinate, equal or tapering downwards, 28—48 ⇌ 9—16 mm. — Context white; taste mild; odor weakly of *Lactarius volemus.*

Spores 8—9 ⇌ 7—8.3 μ, orn. 0.6—1.2 μ, most frequently 0.8—1 u, of type II with a variable number of III a-type spores intermixed in each print, the latter often with short ridges or chains (IV—II, VIII—IV); cystidia more crowded at the edges than on the sides of the lamellae, e. gr. 88 ⇌ 12 μ, in general like those of *R. alachuana* and *R. amoena;* subhymenium and hymenopodium of about equal diameter, the former distinctly cellular; epicutis of pileus with ciliate dermatocystidia of two types, with short and broad but not spherocyst-like basal cells, which become longer the closer they are to the hypodermium, all more or less in erect chains forming a palisade, or slightly interwoven (trichodermium); dermatocystidia of type I e. gr. 47 ⇌ 5 μ, needle-like, very elongate and acute, type II a short subvesiculose cell, clavate to balloon-shaped, with broadly

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rounded tip, e. gr. 9—10.5 μ in diameter; hypodermium formed by a cutis, its hyphal elements strictly filamentous and slightly interwoven, some filled with a colloid pigment of deep bluish violet color; surface of the stipe beset with dermatocystidia without contents, needle-like in shape, with ventricose bases, 42—46 ⇌ 8.7—12 μ; macrocystidia none in the carpophores.

Under *Quercus laurifolia* and *Q. virginiana,* also under *Carya* in hammocks, on the ground, also on lawns under oaks in the grass; fruiting from May until October, Florida.

Material studied: Alachua Co., Gainesville, F 9513, FLAS, type. — W. A. Murrill, comm. Singer F 2000, FH. — Singer F 2036, FH. — Highlands Co., Highlands Hammock State Park, Singer, no. number, FH, also F 77, FH.

This species is mainly characterized by the two types of dermatocystidia, the frequently white stipe, and the rather pale surface. It is closest to *R. alachuana* but has, in fresh condition, aside from the other features, deeper colored spore print. It seems that *R. variicolor* becomes gradually more frequent towards the south of Florida but does not enter the tropical zone, while *R. alachuana* is more common in North Florida. This species does not seem to coincide, in its characters, with any of the other American or the European representatives of the subsection to which it belongs.

Russula flavida Frost & Peck in Peck, Ann. Rep. N. Y. State Mus. **32**: 32. 1880.

Syn.: *Russula mariae* var. *flavida* (Frost & Peck) Sing., Bull Soc. Myc. Fr. **55**: 244. 1939.
Russula praeformosa Murr., Lloydia **6**: 214. 1943.

Pileus "capucine yellow" to darker yellow on disc, "buff yellow" to "pinard yellow" on margin (R.), with a viscid (and then readily drying) or dry cuticle, subglabrous to velutinous-pruinose, sometimes glabrescent, sometimes almost scurfy-pruinose, with subacute, later rounded margin which is smooth but sometimes assumes a tuberculate sulcation up to 8 mm. wide, with the cuticle separable up to two thirds of the radius, convex, then applanate to somewhat depressed, 23—100 mm. — Lamellae whitish, then "cartridge buff" (R.), medium broad (5—6 mm.), equal, sometimes subequal, bifurcate at the stipe or not, otherwise simple, moderately close, with e. gr. 82 through-lamellae, broadest in the middle or in the marginal third, adnexed to adnate, sometimes sinuate-subfree, anastomosing in many specimens, spore print not obtained, indicated as cream color. — Stipe "baryta yellow" (R.), extreme base concolor with disc of pileus, smooth, subglabrous, equal or tapering upwards, sometimes with a white apex, solid, then spongy-stuffed, eventually spongy-hollow,

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25—60 ⇌ 8—20 mm. — Context white, also underneath the cuticle, unchanging or almost so, firm, then brittle or spongy-brittle; taste mild or very slightly disagreeable ; odor weak or none.

Spores 6.7—7.5 ⇌ 5.5—6 μ, orn. of type II, or II—III a, lower than in *R. mariae,* more like that of *R. ochroleucoides*; basidia 35—36 ⇌ 10.2—10.8 μ, clavate, 4-spored; pseudocystidia on sides of lamellae with some banded contents, ventricose in the middle, attenuate-subacute, somewhat like the cheilocystidia of *R. alachuana,* 41—50 ⇌ 8.2—11.6 μ, with some banded contents; cheilocystidia fusoid with acute or attenuate-subacute apex like those of *R. alachuana,* "empty", 44—58 ⇌ 3.3—11 μ; epicutis of pileus in palisade, consisting of filiform to slightly cystidioid hyphal ends which are densely incrusted with golden yellow epicellular pigment; hyphae without clamp connections; no bluing (in SV) bodies in epicutis of pileus.

On the ground under frondose trees, mostly oak, fruiting in summer, from New York to Florida and west to Michigan or further west.

Material studied: *Ala.*: Robinson's Springs, Burke 123, FH. — *Fla.*: Sanchez Hammock, Alachua Co., Murrill, FLAS, type of *R. praeformosa.* Also numerous collections from New York, Pennsylvania, Virginia, and Michigan.

Russula ochroleucoides Kauffm., Mycologia **9**: 165. 1917.

Russula dura Burl., Mycologia **16**: 19. 1924.
Russula subochroleuca Murr., Mycologia **30**: 363. 1938.
Russula levispora Murr., Lloydia **6**: 212. 1943.
Russula levisporiformis Murr., Lloydia **8**: 266, 1945 (1946).
Russula lutescentifolia Murr., Lloydia **8**: 267. 1945 (1946).
Russula mariae var. *subflavida* Sing., Bull. Soc. Mycol. Fr. **55**: 244. 1939.

Pileus varying from "chamois" to "antimony yellow" (R.), "light chrome y.", "golden rod", "ta ming", "brass" (M&P), unicolorous, sometimes slightly deeper colored in the center or in the contrary pallescent on the disc, or else bicolorous, "Yucatan" to "raw sienna" on the disc, and "Narcissus" (M&P) on the margin, when older retaining the same colors or partly more sordid, not viscid, smooth or extremely minutely pitted on the margin where it may become (rather rarely) faintly sulcate over a zone 4—5 mm. broad, especially in particularly thin caps, with obtuse to rounded margin, glabrous to velutinous-pruinose or partly granular, partly or entirely glabrescent in age, opaque, convex, very early showing a distinct umbilicus, later depressed in the center with the margin in most specimens remaining convex, rarely entirely infundibuliform in age (in specimens with thin margin), 50—115 mm. broad. — Lamellae yellowish white,

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cream white, or stramineous from the beginning, in side view almost white, often rather thick, rather narrow to very broad (4.5—11 mm.), some forked in some caps at or near the stipe, a moderate number of few forked away from the stipe, close to subdistant, adnate to adnexed, eventually attenuate-descendant; spore print between A and B, much nearer B (Crawshay). — Stipe white, in many specimens with a yellow flush or with a yellow innate pruinosity which varies from distinct to indistinct or absent, often with pale brown base smooth, at least at first, solid, eventually often stuffed or even spongy-hollow, equal or (especially in youth) more or less ventricose, often acuminate at the base, 40—65 ⇌ 9—34 mm. — Context white or partly tinged "chamois" (R.), unchanging, firm, eventually sometimes fragile; taste both mawkish-bitter and acrid, but in some collections either one of these components of the taste absent and occasionally submild.

Spores characteristic because of the low reticulate ornamentation, 7.8—9.8 (10.2) ⇌ 6—8 (9) μ, orn. 0.2—0.3 (1.0) μ, of type III a, few III b, very few occasionally IV, but many with ridges IV—II, or VIII, or even II, more crested or catenulate the younger or more retarded the material [one has the impression that the primary ornamentation does not coincide completely with the pattern of the secondary (exosporial, amyloid) ornamentation]; basidia 33—57 ⇌ (7.7)—10—14.4 μ, 4-spored with 6.6—9 μ long sterigmata; pseudocystidia 40—85 ⇌ 7—12 μ, versiform, mostly ventricose, often acute or with appendiculation, numerous on the sides of the lamellae and very numerous on the edges, with abundant or little contents on the edges, and with abundant contents on the sides, the contents banded, strongly deep blue in cresyl blue mounts and strongly almost blue-black in SV; epicutis of pileus formed by a trichodermium palisade or erect hyphal ends (e. gr. 37—55 ⇌ 2—6.8 μ with thin to thick walls (up to 1 μ in diameter in adult material), often incrusted by resinous or crystalline matter, rather dense, not imbedded in a gelatinous mass, "empty", or, rarely, showing some granular or finely banded contents, but never bluing in SV, some of the hyphal ends resembling primordial hyphae, some the ciliate dermatocystidia; hypodermium formed by a cutis of interwoven hyphae; some in SV bluing conducting elements present in the stipe, but very scattered, 3.8 μ broad.

$FeSO_4$ on the context of the stipe of young specimens pale salmon, later pinkish gray to gray. — Phenol on the context pale vinaceous gray in stipe, becoming "Cordova", pl. 7 A 6, pl. 47 L 6, or "rubient" as in *R. olivacea,* but eventually often darkening to deep chocolate. — Formaline on flesh of stipe varying from pale pink to pale brownish gray. — KOH on pileus somewhat deeper or negative. — NH_4OH on pileus somewhat deeper or negative. — HNO_3 on

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pileus brighter and somewhat lighter yellow. — H_2SO_4 on context of stipe brown.

On the ground in mixed frondose woods (e. gr. under *Quercus laurifolia* in oakpine woods, in *Quercus-Castanea*-woods in the Appalachians, farther north and higher up frequently in *Fagus-Betula* and *Fagus-Acer* woods, or in *Fagus-Tsuga* stands. Fruiting from June until September, in the north usually in July and August. Widely distributed from Nova Scotia south to Florida and west to Michigan, Tennessee and Alabama.

Material studied: Canada, Nova Scotia, Upper Brookside, hardwood forest, A. H. Smith 860, MICH. — *Vt.*: Newfane Hill, authentic material of *R. dura* Burl. MICH. — *Va.*: White Top Mountain, about 4500 ft, Singer V 180, FH. — Mountain Lake, Giles Co., Singer V 263, FH. — Mountain Lake Biological Sta., Singer V 170, FH. — *N.C.*: Flat Creek, Smith & Hesler 10568, MICH. — *Ala.*: Robinsons Springs, Burke 147, FH. — *Fa.*: Magnesia Springs, type of *R. levispora,* FLAS. — Gainesville, types of *R. levisporiformis* and *R. lutescentifolia* and *R. subochroleuca,* all FLAS. — *MICH.*: Ann Arbor, C. H. Kauffman, paratypes, (MICH). — Houghton, C. H. Kauffman, as *R. flava,* MICH. — Tahquamenon Falls State Park, Luce Co., Singer, N 768, MICH, F. — *Tenn.,* type of *R. ochroleucoides* Kauffm. MICH.

The type looks somewhat like *R. compacta* but seems to be this; the paratypes are definitely this species and coincide with all later collections made by the author of the species. *R. dura* Burl. was first suggested as a synonym of *R. ochroleucoides* by the present author later Miss Burlingham admitted herself the identity. It is remarkable how late and how often this common and striking species of the American woods was discovered and rediscovered. In dried material it is often not very easy to distinguish it from *R. flavida* (*R. mariae* var. *subflavida* is apparently only a mild form of *R. ochroleucoides*), but microscopically as well as by the differences of taste in the fresh material, not to mention the SV reaction, there is no difficulty whatever. The pseudocystidia are apparently at the same time gloeo- and macrocystidia, a rare combination found in but few species of *Russula.* It is also a rare example of an acrid species lacking dermatopseudocystidia on the pileus. For this and other reasons, in spite of the obvious affinity between *R. ochroleucoides* and *R. flavida,* the former was set apart from the latter by assigning it to a stirps of its own. — A painting of this species was deposited at the University Museum, Ann Arbar, Mich.

Subsection *Virescentinae* Sing.

Russula chlorinosma Burl., Mycologia **16**: 22. 1924.

Syn.: Russula maculosa Murr., Lloydia **6**: 212. 1943.

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Russula subglauca Murr., Lloydia **6**: 217. 1943.

Pileus a dull white, frequently with sordid or rusty spots (these "honey yellow" to "raw sienna"), or with a partial pale glaucous shade, the areolae, where developed sometimes pale isabelline, the center and patches often near "chamois" (R.) in mature specimens, but also often remaining quite white until age, always pallid white in the cracks, dry or slightly viscid, with scarcely separable cuticle (with difficulty separable over one half of the radius), with initially incurved, smooth, acute or subacute margin, later with straight and obtuse, smooth to short- or long-sulcate margin, pruinate, especially in the marginal zone, in age often rimose, especially in the marginal zone, sulcate zone (where present) 3—5 mm. broad, the marginal rimosity merging or not with the cracks forming in many specimens on a distinctly areolate surface (as in *R. crustosa*), in others merely finely granular, convex and usually umbilicate in youth, then becoming more broadly depressed, arched on the margin, eventually applanate in the marginal region and sometimes concave, 40—78 mm. broad. — Lamellae white, becoming pale cream color, unchanging or staining pale brown where injured, crowded to subclose, equal or with very short lamellulae near the margin, often some or many forked, especially near stipe, where they are usually bifurcate, narrow to moderately broad (5—6 mm.), broadest in the middle, anastomosing or not, arcuate or plane, adnexed to decurrent, often somewhat separating from the apex of the stipe; spore print A, or between A and B (not reaching B in our collections), according to Crawshay. — Stipe white, opaque, sometimes with "honey yellow" or "raw sienna" (R.) dots near the base or occasionally with pale isabelline areas, subrugulose to rugulose, glabrous or subglabrous, solid, firm, subequal, sometimes slightly tapering upwards or downwards, 30—60 ⇌ 10—30 mm. — Context white, rarely becoming slightly brownish or melleous where injured, more frequently unchanging, thin to medium thick but firm-elastic; taste mild in all stages; odor none, or more often characteristically of chlorine of lime like *Amanita chlorinosma,* especially in age, like sweat (*Russula parazurea*) and disagreeable when drying, sometimes the $CaCl_2$ odor stronger and still noticeable in dried material.

Spores 6.5—8.8 ⇌ 5—7 μ, mostly 7.5—8.2 ⇌ 6.2—6.5 μ, orn. 0.1—0.5 μ, mostly 0.2—0.3 μ, of type III b, IV, V, VI, III b—VIII, VII, very rarely III a, the majority usually IV; basidia 32—54 ⇌ 8—10 μ, clavate, 4-spored; cystidia either "empty" or with granular to banded contents (macrocystidia-type, partly or entirely bluing in SV), usually both the "empty" and the macro-type present in a single preparation, (33)—37—75 ⇌ 5.3—11 μ, versiform, usually cylindrical, fusoid, or clavate-subcapitate, fusoid-clavate, either appendiculate or not

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appendiculate, sometimes with double (appendiculate) appendage, rather numerous, with obtuse tip, more rarely subacute or with ampullaceous apex; edge of lamellae homomorphous; cheilocystidia not differentiated; subhymenium rather thin, subcellular; hymenophoral trama with large spherocysts and rather extensive connective hyphae; epicutis of pileus formed by a palisade consisting of chains of spherocysts (subcuticular layer) intermixed with dermatocystidia of the ciliate type with more elongated basal cell, with hair-shaped, rarely globulose terminal member (e. gr. 10—22 ⇌ 7—18 μ), some of the elements of the chains more elongated and becoming increasingly narrower toward the terminal member, the latter usually subulate or cylindrical, exceptionally clavate (e. gr. 22 ⇌ 9 μ), some occasionally with a melleous incrustation; this epicuticular layer often interrupted by areas where the hypodermium is naked (cracked forms); hypodermium formed by a cutis consisting of repent hyphae which are strongly elongated, the upper portion colorless or pale greenish melleous and slightly gelatinized, the lower portion (hypodermium proper) always pale greenish melleous (NH_4OH) and nongelatinous; ciliate dermatocystidia of the pileus ampullaceous or subulate, hyaline, 20—32 ⇌ 4—10.2 μ, the attenuate portion usually 2.3—3.3 μ broad; elongate hyphae of hypodermium 2.5—4.5 μ broad, all without clamp connections; on the surface of the stipe numerous subfasciculate hyphae, erect or ascendant, cylindrical or sometimes capitate, reaching 3.5—4.3 μ in diameter.

$FeSO_4$ usually everywhere, even on the surface of the pileus: salmon, "buff pink" or "Mikado brown", sometimes "vinaceous cinnamon", in one collection as above, but interior of stipe sordid. — Phenol: slowly chocolate with flesh. — Metol: strongly positive. — SV on dried surface of stipe red ("garnet brown", R.). — Sulfoformol, formalin (both on fresh context), and chlorovanillin (on dried stipe) negative.

In low, mesophytic and high hammock, and in oak-pine woods, apparently connected by mycorrhiza with *Quercus* specc., fruiting from May until November, in Florida, Alabama, and north to Tennessee.

Material studied: *Ala.*: Montgomery, R. P. Burke, in H. A. Kelly's Mycological Herbarium no. 1927, MICH, type of *R. chlorinosma.* — *Fla.*: Alachua Co., Prairie Creek Hammock, Murrill, F 17983, FLAS, type of *R. maculosa.* — Planera Hammock, West & Murrill, FLAS, type of *R. subglauca.* — Gainesville, Singer F 1901, FH. — Newnans Lake Singer F 2917, FH. — Ibid., Murrill, FLAS. — West end of Payne's Prairie Murrill, F 18083, FLAS. Sugarfoot Hammock Murrill & West, Arnold & Murrill, F 18068, F 18517, and others, FLAS. — Levy Co., Gulf Hammock,

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Murrill F 19104, FLAS. — *Tenn.*: Cade Cove, A. H. Smith, MICH. LE.

This species differs from related ones in the following distinctive characters: Lack of pigmentation in the pileus, consistently mild taste, constantly homomorphous gill edges, characteristic odor. It is common in its geographical area, but often misinterpreted, either by misdetermination as a bleached *R. virescens* (which does not occur in Alabama and Florida), or mixed up with the other white Russulae. Since the type has been studied, it has become unnecessary to add *sensu* Sing. to the name as has been done in some of the author's previous publications.

Russula heterosporoides Murr., Lloydia **7**: 310. 1944.

Pileus dull white with some pale isabelline scabrosities or with slightly yellowish center, moist but not viscid in wet weather, smooth but short-striate-tuberculate at the margin, pruinate to partially covered with faint granular scabrosities, with the cuticle peeling part way to the center, with subacute margin, convex, then convex with depressed center, 60—80 mm. broad. — Lamellae white, unchanging, medium broad to broad, simple, but sometimes bifurcate, equal or with few lamellulae, plane subclose to crowded, adnexed to slightly decurrent; spore print "chalk white" according to Murrill's notes. — Stipe white, glabrous, longitudinally grooved or lined, or smooth, equal or tapering downward, 60—80 ⇌ 15—25 mm. — Context white, unchanging or slightly brownish when wounded; taste mild; odor none.

Spores 7.2—8 ⇌ 4.3—5.2 μ, ellipsoid (constantly so when mature), orn. very slightly projecting, appearing smooth in ammonia, of type (VI?)—VII; basidia 42—55 ⇌ 9—11.5 μ, 4-spored; cystidia "empty" or with fine (never banded) granulosities in the lower portion, 43—70 ⇌ 7.5—10.5 μ, versiform, usually ventricose, but also often ampullaceous, with rounded to acute tip and often with mucronate or appendiculate apex, projecting about 16 μ beyond the basidia; subhymenium formed by a layer about 30 μ in diameter, not clearly cellular; hymenophoral trama vesiculose with many filamentous hyphae intermixed; oleiferous hyphae also present, hyaline 2—8 μ broad; epicutis of pileus with typical Virescens-structure, i. e. consisting of a pseudoparenchymatic (subcuticular) layer with most of the outer spherocysts being continued into hyphous short mucros; all hyphae without clamp connections.

Under oak and pine on the ground, rare in North Florida, fruiting in April and September.

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Material studied: *Fla.*: Gainesville, April 28, 1939, Murrill F 19110, FLAS, type of *R. heterosporoides.* — September 9, 1938, Murrill F 18153 (as *R. heterospora* Beardslee), FLAS.

Although I have not collected this rare species myself, I feel certain that it is a good species parallel to *R. chlorinosma* as *R. heterospora* is parallel to *R. cyanoxantha,* with the shape of the spores offering an easy way of distinguishing the two species. The macroscopical notes are partly collector's notes, partly checked on the dried material; the anatomical data were taken from the specimens cited above.

Russula crustosa Peck, Ann. Rep. N.Y. State Mus. **39**: 41. 1887.

Pileus initially with a pale vinaceous tinge or brownish vinaceous or pale lilac color, or at least with a faint grayish violet tinge tending to buff in the center and often pale gray or green in other places, areolate all over or not breaking off into areolae, more often areolate and then the areolae eventually buff or bleaching to pallid, the upper layer (which breaks off) often sordid at first, the areolae not always regular, often broader in the middle and smaller toward the margin, sometimes appearing dark blackish green (deeper than in *R. virescens*) when young, dry, with smooth margin, with subacute to subobtuse margin, convex and usually umbilicate, soon depressed with arched margin and eventually applanate with depressed center, 40—120 mm. broad. — Lamellae white, then cream color, close to crowded, but eventually often distant in the marginal zone of the pileus, rather narrow to very broad 6—11 mm.), simple or some to many forked, both at the stipe and half way to the margin of the pileus, equal, sometimes connate at the stipe, and slightly anastomosing, broadest in the marginal third, attenuate-attingent, adnexed or adnate; spore print between A—B and D, in tone near "light buff" (R.) or "cartridge buff" (R.), remarkably variable, in the northern collections generally paler colored than in Florida collections. — Stipe pure white, in age rarely a very pale fawn color tinge present, generally opaque, glabrous, subrugulose, solid, sometimes becoming hollow in age, equal, subequal, ventricose, or pinched off at base, 35—65 ⇌ 10—25 mm. — Context white, unchanging, firm at first; taste mild or slightly acrid and at the same time often very slightly bitterish in young lamellae, in age never peppery; odor none, but in age often becoming noticeably unpleasant, of sweat (as in *R. parazurea*) when drying, otherwise somewhat fetid or like smoked herring, not like *Amanita chlorinosma.*

Spores 8.7—9.5 ⇌ 5.5—7.8 μ, orn. 0.1—0.4 μ, of type III a, III b, IV, VIII few VI; basidia 39—50 ⇌ 8—10.8 μ, 4-spored; cystidia often partly or all of the macrocystidium-type, i. e. with banded contents

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almost all over and then distinctly bluing in SV in and beyond the apical zone, but many "empty" ones or non-bluing ones also intermixed and sometimes all of them without any banded contents, numerous, fusoid to clavate, sometimes with constrictions, obtuse or acute, often with mucronate or appendiculate apex, 41—110⇌5.5—14 μ; cheilocystidia often strongly differentiated, 4—10.8 μ broad, versiform, often with a septum in the middle or near the base, without banded and rarely with any contents, only exceptionally a very few with some banded contents, with obtuse apex, often with appendage (up to 4.2 μ long, making the edge heteromorphous; epicutis of pileus with a pseudoparenchymatic layer (subcutis)with spherocysts showing piliform erect excrescencies at the tip in the uppermost layer, the vesiculose base of these ciliate dermatocystidia 8.5—22 μ in diameter, the cystidioid cell 13—44 ⇌ 3—4.2 μ, cylindrical or tapering upwards, but not acute, often with a septum near the basal cell or in the middle, or else not divided by a septum from the underlying vesiculose elements, rarely branched-forked, the basal cells usually continued downwards in chains with some occasional cells somewhat elongated (same breadth but longer); hypodermium consisting of repent hyphae, forming a cutis, 2—2.8 μ in diameter; scattered oleiferous hyphae also present, 3.5—7 μ in diameter; on the surface of the stipe dermatopseudocystidia with banded contents (bluing in SV) observed, clavate-elongate.

$FeSO_4$ on context gray- sordid, in cortex of stipe salmon, on lamellae pinkish gray to grayish pink-sordid with a slight salmoneous tinge. — HNO_3 on surface of pileus citrin where it had been buff, pale cinnamon where it had been green or violet-purple, but here also eventually becoming citrin with a salmon ring.

The author has made various attempts to segregate the forms of this somewhat variable species by the color of the pileus, the number of "empty" cystidia in the hymenium, the ornamentation of the spores, and the color of the spore print. As is known now, the extent of the bluing of the cystidia is somewhat variable in the European *R. virescens,* and so is the color of the spore print. This variation seems to depend on the microclimate and macroclimate so that it appears futile to distinguish races at the present time. Both *R. crustosa* and *R. virescens* seem to be quite parallel in many regards, and differ mainly in the constantly mild taste and the constant absence of a purple or violet color in the pileus, also perhaps in a lower average of occurrence of macrocystidia in the hymenium in *R. virescens.* I am afraid that many collections, allegedly of *R. virescens,* in the United States are actually green forms of *R. crustosa. R. virescens* ist at least rarer and less widely distributed than *R. crustosa* in the United States and Canada.

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Although a possibility of an infraspecific subdivision of what we describe as *R. crustosa* is not entirely rejected, the author feels that he has in spite of a large number of specimens collected by himself and by others, and studied carefully in all regards, no true factual basis for the distinction of subspecies, varieties, or formas. Consequently all collections are enumerated below without distinction as far as, possibly coincidental, character correlations are concerned.

Habitat: On the ground in woods, mostly with Fagales, Eastern United States and Canada, in Florida in high hammocks, fruiting from May until September.

Material studied: *Mass.*: Wakefield, Singer M 145, FH. — Walden Pond, Singer, FH. — *N.Y.*: Whitehall, authentic material collected and determined by Peck, NYS. — *N.C.*: Newfound Gap, Hesler & Smith 10640, MICH, LE. — *Fla.*: Alachua Co., Gainesville, Singer S 2189, F 2502, FH.

Subsection *Lilaceinae* Melzer & Zvára

Russula westii Murr., Mycologia **33**: 443. 1941.

Pileus white, whitish, or dull white with a stramineous tinge, rather uniformly colored, slightly viscid when wet and drying out rapidly, glabrous, with somewhat separable cuticle (not peeling easily, but without breaking up to two third of the radius), with smooth, eventually often short, sulcate margin, with obtuse, later broadly rounded margin, smooth in the central portion, convex, soon with depressed center, 22—68 mm. broad. — Lamellae white, then cream color, simple or many bifurcate at the stipe, anastomosing, equal, medium broad to very broad (5—10 mm.), moderately close to close, sinuate with slightly decurrent tooth, or adnate; spore print C (Crawshay. — Stipe white, unchanging, smooth, equal or subequal, or tapering downward, always shorter than the diameter of the pileus, solid, eventually often becoming hollow, 20—25 ⇌ 10—14 mm. — Context white, unchanging; taste mild; odor none.

Spores 6.8—10.5 ⇌ 5—6.7 μ, mostly short ellipsoid, occasionally reaching a Q (length / breadth) of 1.6, with orn. 0.2—0.7 μ, of type IV, also III b, V, VI—VIII, II—IV, etc., very few spores with orn. type III a or III a—VIII; basidia 30—36 ⇌ 8.8—10.5 μ, 4-spored; cystidia with or without contents, those with contents filled with an amorphous, banded or granular yellow mass, 68—107 ⇌ 6.5—11.7 μ, fusoid or ventricose, often with somewhat thickened wall as in *R. alachuana,* often with button-like or rod-like appendages, but also frequently rounded at the tip and without appendage, moderately numerous to numerous at and near the edge, less numerous away from the edge; epicutis of pileus hyphous, the hyphal ends often ascendant and pilose, sometimes even nodulose, but generally little

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modified, slightly gelatinized; primordial hyphae none or few; dermatopseudocystidia none; hypodermium little differentiated, consisting of repent, less or not gelatinized and broader hyphae; all hyphae hyaline and without clamp connections.
$FeSO_4$ on context of stipe pale salmon. — H_2SO_4 on pileus negative, eventually somewhat sordid reddish as in most white species). — KOH on pileus negative. — Metol on context negative. — Phenol on context chocolate. — Chlorovanillin: negative with dried context of stipe.

On the ground under *Quercus* and *Pinus,* fruiting from June until November; known only from Florida.

Material studied: Alachua Co., Gainesville, West F 16404, type, FLAS. — West of Newnans Lake under live oak, Weber F 18081, authentic material (det. Murrill), FLAS. — Ibid., Singer F 2781, under *Pinus palustris,* FH.

Russula cremea (Murr.) Sing., Lilloa **22**: 711. 1949 (1951).

Syn.: *Russula heterospora* var. *cremea* Murr., Bull. Torr. Bot. Cl. **67**: 57. 1940.

Pileus white, opaque, tending to show broad rusty ocher spots when dried, with smooth rounded-obtuse margin, glabrous or subglabrous on the margin, with scarcely separable cuticle, or with easily separable cuticle part way to the center, slightly viscid in very wet weather but drying out rapidly, convex and umbilicate at first, later becoming depressed with arched marginal zone, 30—70 mm. broad. — Lamellae white, becoming cremeous, moderately broad, or broad (3—5 mm. in the smaller specimens), sinuate or attingent and becoming subdecurrent, subdistant to almost crowded, equal, simple or some forked; spore print C (Crawshay). — Stipe white, sometimes somewhat honey yellow at base, glabrous, smooth, equal or tapering downward, shorter than the diameter of the pileus, 24—40 ⇌ 10—17 mm. — Context white, comparatively thin or moderately thick, unchanging; taste mild or occasionally perhaps very slightly astringent (?); odor none.

Spores 9.3—11.7 ⇌ 5—6.6 μ, very few as "broad" as 10.2 ⇌ 7.5 μ, or as "short" as 8.2 ⇌ 6 μ, the great majority distinctly elongated with a Q of 1.5—2.1; orn. 0.2—0.4 μ, of type III a, III b—VII, IV, V—VII, always (?) with a large number of reticulated spores in a print, never projecting as much as 0.7 μ, subsmooth in ammonia, with ellipsoid central oil droplet; basidia 39—41 ⇌ 8—(11) μ, hyaline, comparatively narrow, 4-spored; pseudoparaphyses present, often with subcapitate broad apex; cystidia either "empty" or filled with amorphous yellow contents, some also yellow incrusted, but incrustation easily washed off, with rounded tip, more rarely with a short appendage, fusoid,

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40—63 ⇌ 7.5—11.7 μ, fairly numerous; hymenopodium and subhymenium both differentiated, about equally braod, the latter more subcellular, the former more hyphous, both very dense; hymenophoral trama vesiculose, with fairly numerous filamentous hyphae, epicutis of pileus consisting of filamentous hyphae, very similar to those of *R. westii,* running tangentially or vertically, somewhat or strongly gelatinized, often many transformed into pilose bodies whose short-septate basal bodies remind one of those of ciliate dermatocystidia but the terminal member not truly cystidioid and extremely long and hyphous in most cases, more or less parallel with each other but very loosely arranged, all elements smooth and hyaline except at the brown spots of the pileus where they have brown walls, without contents, only very rarely with some scattered granular contents but hardly dermatopseudocystidioid, many thickened below the septum into basal elements of 10—13 ⇌ 6.7—7.5 μ (broader) which are catenulate and thus forming a rudimentary "subcuticular" layer; hypodermium formed by a cutis consisting of horizontal hyphae and a few chains of spherocysts (at places); all hyphae without clamp connections; occasional primordial hyphae with broadly rounded tips seen on the surface of some specimens.

Under "turkey oak" in rather open places on sandy soil, perhaps also under other species of *Quercus* in high hammocks, rare, fruiting from July until September, in North Florida.

Material studied: Alachua Co., Sugarfoot Hammock, type, FLAS. — Ibid. Singer, topotype, FH.

The two preceding species, *R. westii* and *R. cremea,* are exceedingly similar and differ from each other only in spore characters. They can therefore be considered as being related to each other in the same way as *R. cyanoxantha* and *R. heterospora.* Nevertheless, there is one collection which I have studied, and which seems to be somewhat intermediate between the two species. It was observed under pines in Cary Forest, November 19, 1938 by Murrill, FLAS, and the spores were as elongated as those of *R. cremea* although no reticulated ornamentation on any spore could be found (orn. III b, IV, V, VI—VIII, etc.). This collection is tentatively determined as *R. cremea,* but it shows that the distinction of the two species is not always easy, unless one insists on the spore shape alone which does not seem to be correlated with any other character. It is true that subellipsoid spores are not usual in *Russula* and appear to have considerable weight, on the other hand species with elongate spores seem to occur in various otherwise unrelated groups, even in the *Fragiles,* and it is not a priori certain that this character always has specific significance. Unfortunately, the chemical characters of *R. cremea* remain unknown and can therefore not be compared with

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those of *R. westii*. It is possible that they present a correlated character. Otherwise, additional studies are necessary in order to find out whether, in this case, the spore shape is an absolutely constant character.

Russula glaucescentipes Murr., Lloydia **6**: 211, 1943.

Pileus from pale purple to bright pink, e. gr. "rose doree" (R.), viscid when wet but only slightly so and drying out very rapidly, in dry condition (visible also in herbarium material) always granular-velutinous to granular-rivulose, with rounded-obtuse margin, smooth all over, with the cuticle separable only part way to the center, convex with depressed center, 37—39 mm. broad. — Lamellae white, often bifurcate near the stipe, somewhat ventricose, adnexed, rather broad to broad, crowded to close, equal or subequal; spore print white, (between A and B, not reaching B). — Stipe white, in dried condition becoming reddish at the apex and ochraceous brown at the base, often glaucous when dried, between the pink zone and the ochraceous base, pruinate at apex, glabrescent, equal or with slightly thickened base, the latter (in the type specimen) sometimes with an attenuate earthy-mycelioid tail-like continuation, 20—28 ⇌ 8—10 mm. — Context white, unchanging; taste mild; odor none.

Spores 7.5—9.8 ⇌ 6.8—8.2 μ, some with a slight yellowish shade in ammonia, but mostly subhyaline, orn. 0.3—1 μ of type V and VI, some IV, fewer spores with some short rows of warts touching each other (III b—II—VIII or IV—II—VIII), but not always varying to include such ornamentations; basidia short, 20—40 ⇌ 7.5—9.2 μ, clavate, 4-spored, sometimes a few 2-spored ones present; cystidia with finely banded to granular contents, sometimes only in the apical portion, sometimes far beyond the middle, 44—57 ⇌ 6.8—10.2 μ, clavate, fusoid, or cylindrical, appendiculate or not, appendage up to 7 μ long; edge of lamellae subheteromorphous; cheilocystidia not differentiated; subhymenium cellular; hymenophoral trama cellular; epicutis of pileus consisting of conspicuously intimately interlaced and dense hyphae with some strange elongate elements which are not incrusted but have granular contents which turn into ladder-like-pseudosepta at places; ciliate dermatocystidia none; dermato-pseudocystidia none on pileus and stipe; *Virescens*-structure none on pileus and stipe; surface layer of stipe consisting of "empty" filamentous hyphae. —

SV on dried stipe slowly but rather deeply dull carmin, becoming brownish or reddish brown after 20 minutes.

On the ground under oaks, solitary, rare, fruiting in spring and fall, North Florida.

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Material studied: Alachua Co., Gainesville, Oct. 17, 1938, Murril, F 18383, FLAS, type. — Ibid., Singer, May 20, 1943, F 2032, FH.

It probably depends on the age and condition of the material before drying whether or not the central portion of the stipe turns glaucous in the herbarium. The reddish tinge at the apex, however, is distinct on both Murrill's and the author's material and was not present in fresh material. The surface of the pileus of both type and topotype appears minutely cracked so that one may be tempted to think of subsection *Schizoderminae*.

Russula subinconstans Murr., Mycologia **38**: 226. 1946.

Syn.: *Russula inconstans* Murr., Lloydia **8**: 266. 1945, non Burl.

Pileus very characteristically pure pink color ("La France pink", "coral pink", "shrimp pink", "Chaternay pink", "jasper pink", reaching "light jasper red" (R.), with white areas, more rarely with yellowish areas), slightly viscid when very wet, but drying out rapidly, minutely granular-punctulate, with rounded-obtuse, smooth margin which frequently becomes indistinctly short and deep sulcate in age, convex then applanate or convex with narrowly and slightly depressed center, eventually often concave, 24—55 mm. broad. — Lamellae white, broad (3—8 mm.), subclose to subdistant, anastomosing, subfree or narrowly adnexed, plane or ventricose, equal and simple, occasionally with a very few shorter or forked ones; spore print pure white, A (Crawshay). — Stipe white, glabrous, smooth or subrugulose, equal, subequal, or tapering upward, solid, then becoming stuffed-hollow, 25—50 ⇌ 5—12 mm. — Context white, unchanging; taste mild; odor none.

Spores 6—9.5 ⇌ 5.8—8.2 μ, orn. 0.2—0.9 μ, of type III b and IV, fewer spores type III a, some with short ridges (II—IV) or II—III b, III b—VIII, etc.; basidia 27—44 ⇌ 9.2—12(15) μ, mostly clavate, mostly 4-spored (often a few 2-spored ones intermixed), the two-spored basidia often constricted underneath the tip; cystidia identical on sides and edges of lamellae but scattered to very scarce on sides (edge subheteromorphous), 55—75 $\frac{1}{2}$ 8—13.5 μ, fusoid, subfusoid, ventricose-ampullaceous, clavate, with or without appendage (the latter 1—16 μ long), with or without some scattered granular or banded contents, with acute to broadly rounded tip and most of the contents frequently concentrated there (if present) whereas the lower portion remains without contents or with scattered very finely granular ones, in SV one third to one half bluing; hymenopodium and subhymenium both well developed, the former hyphous; hymenophoral trama vesiculose but with fairly numerous filamentous hyphae intermixed; epicutis of pileus consisting of ordinary hyaline smooth thin hyphae and very numerous primordial hyphae with yellowish or hyaline incru-

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station (the primordial hyphae 4—5.2 μ thick); dermatopseudocystidia none; hypodermium pink from an intracellular dissolved pigment with some small spherocysts among the hyphae forming the cutis of the hypodermium.

$FeSO_4$ on context of stipe pale drab to reddish gray. — Phenol on flesh at first "light purplish vinaceous" to "deep livid brown" R., eventually "dark vinaceous brown" R., reaching a deep chocolate in the end. — Metol: strongly positive.

On the ground in groups, in dry pine woods and low mixed woods under pines fruiting from July until September. North Florida.

Material studied: Alachua Co., near Gainesville, Sept. 15, 1943, Murrill, F 18105, FLAS, type. — Gainesville, July 11—17, 1943, Singer, F 2700, FH.

This is a beautiful pink species which differs from other species with white spore print in its particular color. *R. pulchra, R. uncialis,* and *R. mallophora* seem to be closest.

Russula praetenuis Murr., Lloydia **6**: 215. 1943.

Pileus "Venetian pink", "alizarin pink", "rhodonite pink", "coral red", "deep vinaceous", often darker in the center and reaching "Nopal red" or "Indian red", or "Madder brown", in dried condition often "deep livid brown" in the center and "light purplish vinaceous" on the margin, also "Corinthian pink" to "jasper pink", "light Corinthian red" (R.), finely granular and velutinous, viscid when wet but drying out rapidly, with separable (from one half to entirely) cuticle, with smooth, then 2.5—10 mm. broad sulcate margin, smooth otherwise, with broadly rounded margin, convex, soon with depressed center and arched margin, often becoming applanate, 20—70 mm. broad. — Lamellae white, assuming a "cartridge buff" (R.) tinge when old or dried, rather broad to broad, 4.5—8 mm. broad, varying from slightly arcuate to ventricose, broadest either in the outer or in the middle third, bifurcate near the stipe, otherwise simple, equal, close to medium close, attingent-subfree to adnate-subdecurrent; spore print between A and B, nearer to A, or pure white (A, Crawshay). — Stipe white with a faint flush of pink to entirely rose color ("Chaternay pink", "jasper pink", "light jasper red", R.), the apex sometimes red-dotted-scurfy, equal or sometimes laterally compressed, also sometimes very slightly tapering downward or ventricose, rarely tapering upward, with rugose ridges or smooth, solid, becoming stuffed or hollow, 20—60 ⇌ 5—12 mm. — Context white, unchanging; taste mild; odor none.

Spores 7—10.2 ⇌ 6.8—8.5 μ, sometimes mostly 7—8 μ long, sometimes predominantly 7.5—9.2 μ or 8.8—10.2 μ long, orn. 0.4—0.9 μ, mostly 0.4—0.7 μ, of type IV (often many spores with short ridges:

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IV—II), also III b—VIII, fewer V, VI, III b; basidia 26—32 ⇌ 8.8—11.7 μ, sometimes clavate, sometimes clavate-ventricose, 4-spored; basidioles and pseudoparaphyses like the basidia, very short and vesiculose; cystidia varying in shape and contents, 48—62 ⇌ 7.5—8.8 μ, if they are macrocystidia, and then with banded contents and appendage (4—8 μ long), the others belonging to two types but not always both types present, type 1 short, vesiculose, 10—17 ⇌ 7.5—10.5 μ, type 2 elongate, (13.5)—30—55 ⇌ 6—11.7 μ, this type being predominant in those caps where the broadest elements of the cuticle of the pileus are scarce or absent; edge of lamellae subheteromorphous to nearly homomorphous; subhymenium consisting of small, irregular, densely interlaced elements which give a subcellular appearance, at the gill edge, however, not continued; hymenopodium of elongated elements, continued over the edge; epicutis of pileus consisting of two layers, 1) an interrupted thin layer consisting of characteristic primordial hyphae which are repent and often strongly interwoven, hyaline or yellow, incrusted by a yellow amorphous mass, sometimes with some fine granular contents, 2) another layer, for the most part palisadic or almost so, consisting of hyphae and conspicuous swollen catelnulate elements, both rising from a swollen cell and often ending up in a large cystidioid body (13—30 ⇌ 7—18.5 μ), the relative abundance of the hyphae and the swollen elements depending on their position on the pileus and also on individual variation; hypodermium of pileus consisting of a thin cutis of predominantly filamentous hyphae, both these and the hyphae of the lower epicuticular layer pink from an intracellular dissolved pigment; all hyphae without clamp connections.

Phenol on context rather slowly to chocolate. — Metol strongly positive, reaching "blackish purple" R. or "deep naphthalene violet" R. — Chlorovanillin on dried stipe negative.

Under various species of *Quercus* on high as well as low ground in frondose and mixed stands from Alabama south to Highlands Co., Florida, but absent in the tropical region of the state, fruiting from June until September.

Material studied: *Ala.*: Robinsons Springs, Burke 134, FH, probably also Burke 156 (see notes), FH. — *Fla.*: Alachua Co., Seven Mile Church, Murrill, F 21508, FLAS, type. — Highlands Co., Highlands Hammock State Park, Singer, F 297, F 226, F 226 a, FH.

Russula praetenuis is rather widely distributed in the South and frequent at places. The northern *R. uncialis* Peck differs only slightly but is undoubtedly not identical since it has a positive chlorovanillin reaction which is not as strong as in *R. aurora* but still definitely different from that of *R. praetenuis*. Moreover the color of

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the pileus is more pink to purple-lilac than in *R. uncialis*. Burke 156 from Alabama seems to be somewhat intermediate between *R. uncialis* and *R. praetenuis* but since I have not seen fresh material myself, I refrain from hasty conclusions.

Russula luteobasis Peck, Bull. Torr. Bot. Cl. **31**: 179. 1904.

Pileus flesh color, with cinnamon buff center and a cream buff middle zone, smooth, soft, glabrous, not roughened or ridged, with the pellicle separable over one third of the radius, not viscid, with rounded tuberculate-sulcate margin at maturity (over a zone of 6 mm.), convex, about 50 mm. broad. — Lamellae "cartridge buff" R. in side view, sinuate, close, not forked, rarely bifurcate at stipe, equal, with even to minutely eroded edges; spore print between B and C, in thick layer C (Crawshay) after several years, fresh and thick layer in tone "pale pinkish buff" R., never white. — Stipe whitish to "cartridge buff" (R.), with "antimony yellow" R. base, the latter often reaching "ochraceous orange" (R.), under lens minutely darker scurfy at times, moderately compact, equal with slightly tapering lower portion, about 30 ⇌ 10 mm. — Context white, also underneath the cuticle, unchanging; taste mild; odor not recorded.

Spores 7.5—9.3(11.5) ⇌ 6.4—7.5(9) µ, orn. 0.5(0.7) µ, of type II, III a, III b, VIII, rarely IV, V, on most spores III (from print); basidia 21—37.2 ⇌ 8.7—10(—13) µ, 4-spored; cystidia not numerous, with finely or sparsely banded or more often merely granular contents, 40—62 ⇌ 6.3—8(10) µ, appendiculate, apparently not of the macrocystidium-type; cheilocystidia similar, mostly "empty", mostly about 41 ⇌ 4—5.5 µ; epicutis of pileus formed by floccons of septate hyphae with cystidioid ends (these clavate-subvesiculose, hyaline, smooth, about 7 µ broad), and between the flocci with yellow primordial hyphae, 3.5—6 µ broad; also some transitions between the hyphae and the primordial hyphae observed; all hyphae without clamp connections.

On the ground, gregarious among thin grass in low woods, June, Alabama, and northwest to Missouri.

Material studied: *Ala.*: Robinsons Springs (?), Burke 73, F. — *Mo.*, type of *R. luteobasis*, NYS.

The Alabama collection was compared with the type. The description, however, is made up exclusively from the excellent material collected by R. P. Burke who says the pileus resembles a ripe peach in color; the flesh is moderately compact, not fragile. The lamellae, according to his drawings, are rather broad. While this author inserted *R. luteobasis* among the *Integrae (Fragiles)* in his earlier publications, although always with strong reservations,

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especially because of the absence of data on the color of the spore print, it seems now quite clear that this species belongs in the *Lilaceinae (Rigidae)* because of a number of characters now apparent from Burke's collection. The rather compact flesh makes it comparable to *R. lepidiformis.*

Russula lepidiformis Murr., Mycologia **30**: 363. 1938.

Pileus beautifully pink ("springtime" to "Mephisto" M & P) to sordid pink (a general intermingling of "coral red", "coral pink", "cartridge buff" and sordid cream buff whereby the outer two thirds are usually more pink than the disc), and also frequently assuming such (Ridgway) colors as "Japan rose", "testaceous", "comeo brown", "Indian red", "light Corinthian red", "orange vinaceous", "russet vinaceous" with cream colored or pallid spots, thus reminding one of the colors of *Boletus rubricitrinus* Murr., dry, never viscid, usually found with some rimose cracks or rimulose-squamulose in places or else subvelutinous to densely pruinate-velutinous, with even, smooth, broadly rounded margin, convex, then convex-applanate, eventually applanate-convex or applanate-concave, with nearly adnate cuticle, 48—68 mm. broad. — Lamellae white, whitish, close (126 at stipe) to distant, narrow (e. gr. 2.5 mm.) to broad (e. gr. 11 mm.), often subventricose to ventricose, rigid, attenuate, and bifurcate at the stipe (at least in some carpophores), adnexed or sinuate-free, equal, anastomosing or not; spore print from between A and B (nearer A) to B (more frequently B), in the scale of Crawshay. — Stipe white or chalk white to milk white, often but not always with a pink flush ("Japan rose" mixed with "Naples yellow", or a pure "pinkish vinaceous" R.), pruinose, often glabrescent, subequal, ventricose, or tapering upward or downward or attenuate at the base only, solid, eventually becoming hollow, 30—51 ⇌ 12—21 mm. — Context white, unchanging, hard and thick in the pileus and stipe; taste slightly to strongly bitter and unpleasant; odor of compote of pears or apples, pleasant.

Spores 7.5—11.7 ⇌ 7—10.2 μ, sometimes reaching up to 12.2 μ in length, orn. 0.2—0.8 μ, rarely up to 1.3 μ, generally low, of type III a, III b, III a—VIII; basidia 33—42 ⇌ 12—14.3 μ, clavate and remarkably broad, 4-spored; cystidia 50—88 ⇌ 7.5—12 μ, with granular or somewhat banded contents, rarely "empty", not bluing in SV, fusoid with subacute, rounded or appendiculate (appendage to 9 μ long) tip, more rarely cylindrical or clavate-elongated; cheilocystidia differing from the pleurocystidia only in being constantly "empty" and more irregular at the apex; cuticle of pileus not very sharply divided into epicutis and hypodermium, the uppermost layer consisting of hyphae, many of which form strands, all erect to wildly interwoven, with thin to

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sometimes moderately thickened walls, some with strong melleous incrustation and transformed into primordial hyphae, others multiseptate but little individualized, with thin, pilose, sometimes acute terminal members and sometimes arising from some small inconspicuous spherocysts occurring an the central layer of the cuticle, the lower layer (hypodermium) mainly formed by hyphae which are somewhat broader than in the uppermost layer filled with a dissolved intracellular beautifully pink pigment in some preparations, all without clamp connections; dermatopseudocystidia absent, but some dermatocystidia or primordial hyphae may be recognized, the former even with distinct banded contents at times, 3—6.2 μ diam. elongate-clavate, but often excessively scarce and never bluing in SV; no bluing (in SV) elements present on the surface of the stipe.

$FeSO_4$ on context of stipe salmon or grayish red, on lamellae salmon color. — Phenol on flesh at first somewhat more lilac than ordinarily, deep chocolate brown after a while. — Anilin very slightly reddish, practically negative on the context, causing a yellow spot on the lamellae. — Formalin on context of stipe very slightly reddish, practically negative. — SV with dried stipe negative. — NH_4OH on context negative. — H_2SO_4 on surface of pileus negative.

Material studied: *Mass.*: Belmont, Coffin, det. Singer (fresh), FH. — *Va.*: Mountain Lake, Singer, V 491, FH. — *Ala.*: Robinsons Springs, Burke 162, FH.

This is a species which reminds one strongly of *Russula lepida* of Europe; indeed, all collections of *R. lepida* in the United States appear to be this. However, Kühner & Romagnesi indicate *R. lepida* as being devoid of bluing (in SV) elements in the cuticle of the pileus which is in contrast to the notes this author took in Europe on what he described as *R. lepida* and what is obviously identical with the *R. lepida* in the sense of Schaeffer. If there should be, in France, another species, currently determined as *R. lepida* but without dermatopseudocystidia on pileus and stipe, it becomes rather doubtful whether it is different from *R. lepidiformis* Murr.

In Florida, *R. lepidiformis* almost merges into a Floridian species *R. hixsonii* Murr. (see below). The spores with ornamentations higher than usually found in this species (*R. lepidiformis*) occur only in that state, and can be distinguished from those of *R. hixsonii* only by the less variable extent of the reticulation; the spores are also generally slightly smaller, and the taste is never acrid; likewise, we do not find the spore print deeper than B in *R. lepidiformis*. Nevertheless, the interpretation of the types of these species offers certain difficulties since one has to rely on the data given by Murrill and the rather small number of spores found on the lamellae of the type of *R. lepidiformis*. But a careful comparison with our own col-

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lections as well as the identity of the locality from where they came, makes a decision possible, and it is here assumed that the types and our own respective collections belong to the species assigned to them.

Aside from *R. hixsonii* there may be another Florida species close to *R. lepidiformis* which differs in the less reticulated spores. Until more data are available on this form, it may conveniently be considered as a doubtful form of *R. lepidiformis*. Considering the wide range of spore ornamentation variation in *R. hixsonii*, it would not be surprising to find a similar variability in *R. lepidiformis* although this would tend to make the affinity between the two species even closer.

Russula hixsonii Murr., Lloydia **6**: 212. 1943.

Pileus beautifully pink to rose red and uniformly colored or with pallid to "light buff" places in the center, in fresh condition between "jasper red" and "Eugenia red" or between pink and cinnabarinous, in dried condition e. gr. "Congo pink", "Chaternay pink", "La France pink", "Daphne red", "Hellebore red", "spinel red", "pomegrenate purple", R., strongly pruinose-subvelutinous, but shining when wet and then appearing glabrous, eventually glabrescent, with the cuticle separable only with difficulty up to 4/5 to the radius, with smooth, eventually sometimes pectinate, broadly rounded margin, but attenuated gradually toward the margin, convex-umbilicate, then depressed in the center, with arched to applanate margin, eventually often concave, 60—150 mm. broad. — Lamellae pale cream color, anastomosing, often with some forked ones and or some lamellulae intermixed, rather narrow (5 mm.) to broad (12 mm.), ventricose or plane to even somewhat arcuate, broadest in outer third, subclose to distant, adnate or free with decurrent tooth, adnexed or becoming subdecurrent and then often separating from the stipe; spore print C to D when quite fresh, in the herbarium always becoming C (Crawshay). — Stipe white, often flushed with pink or rose red (between "eosine pink" and "Begonia rose" R.) to nearly concolorous with pileus, in dried specimens "thuilite red" to "spinel red" R., pruinose, glabrescent, smooth, equal or tapering upward, solid, eventually becoming hollow, 35—90 ⇌ 15—30 mm. — Context white, unchanging, but slightly reddish directly underneath the cuticle in the red caps, firm, eventually fragile; taste mild and nutty, but after a while slightly bitter-astringent and subacrid, or seemingly mild but burning in the throat; odor none, but in old specimens often of starch water, or, when beginning to dry, of cookies.

Spores characteristically large, 8.2—14.3 ⇌ 7.5—11.7 μ (12.2—14.3 ⇌ 11—11.7 μ in the type), the larger spores short-ellipsoid, the smaller ones subglobose, with palest yellowish wall, strongly echinate, orn.

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0.2—1.8 μ, mostly 1—1.4 μ, of type III a (III b), rather rarely IV, but the connecting lines varying from thin (but appreciable) to so extremely thin that they are scarcely noticeable and the orn. then appearing of type VI, IV, V; basidia 43—65 ⇌ 10.7—16.3 μ, clavate to clavate-subventricose, all 4-spored, or a few 2-spored; cystidia either with a mediane body of banded contents or granular and "empty" or with very fine and slight scattered bandelettes dispersed all over the interior *), with the shape reminding one of the cystidia of *R. amoena,* i. e. fusoid to subulate, often with acute or at least attenuate-subacute apex, or ampullaceous, rarely capitate, with occasionally some versiform appendage-like excrescencies at the apex, thin to thick-walled (wall 0.7—1 μ thick in the type); 45—115 ⇌ 8.5—13.5 μ, always deep-rooting; epicutis of pileus formed by a non-gelatinous palisade (trichodermium) which may become depressed and cutis-like in age, consisting of ordinary hyphal ends which, however, often are clavate (18—26 ⇌ 5.5—7.8 μ terminal cells), and roughened on the outside, or ampullaceous or otherwise similar to the hymenial cystidia, in young specimens rarely filled with some contents as the hymenial cystidia but in old specimens (as for example in the type) all or almost all "empty", usually 4—5.5 μ but occasionally up to 10 μ broad; hypodermium bright alizarin pink in ammonia but pigment disappearing after a few minutes, consisting of thin filamentous smooth hyphae forming a cutis, in old specimens some of these hyphae inflated to form vesicles or "ampullae" up to 14 μ broad but no true spherocysts visible in most preparations; covering layer of stipe consisting of hyphae and dermatocystidia such as seen on the pileus but more distinctly banded-granular and with more rounded apex, possibly dermatopseudocystidoid (SV reaction unknown); all hyphae without clamp connections.

$FeSO_4$ on context of stipe grayish-reddish. — Phenol on flesh to chocolate. — Anilin negative on context. — Sulfoformol on fresh context of stipe green. — Chlorovanillin on dried stipe "neutral red" but reaction unstable and soon bleached. — SV on dried stipe either brown or "carmin", "oxblood red", becoming soon "Hessian brown" and then black.

On the ground under *Quercus* with some pines, *Serrenoa, Liquidambar,* usually on fairly moist shady places, usually in groups, fruiting from May until October. North Florida.

Material studied: Alachua Co., just west of Newnans Lake, Hixson, F 19081, FLAS, type. — Ibid., isotype, det. Singer, FLAS. — Ibid., Singer F 2171, FH, topotype. Probably also: Sugarfoot Hammock, July 5, 1943, Singer F 2554 a and F 255 a, FH.

*) SV after 6 months negative in well preserved material; chlorovanillin also negative after 6 months.

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Like our material of *R. lepidiformis,* the fresh collection of *R. hixsonii* came from the same spot where the type had been collected. Some of the type collection was left undetermined by Murrill, but must have risen from the same mycelium. The burning sensation observed when masticating the flesh and lamellae is rather peculiar.

Russula roseitincta Murr., Bull. Torr. Bot. Cl., **67**: 278. 1940.
Syn.: *Russula subgranulosa* Murr., Bull. Torr. Bot. Cl. **27**: 279. 1940.

Pileus pink ("pink coral" M&P and paler) mixed with cream color ("maize" M&P and paler), eventually often much bleached and assuming sordid avellaneous-isabelline tones, viscid when quite wet but drying very rapidly and then becoming distinctly granular, especially when seen under a lens, often subrugulose, with rounded smooth or subsmooth entire margin and with a cuticle separable over most of the surface, convex, then depressed in the center with convex then flattened margin, eventually often concave, 60—80 mm. broad. — Lamellae at first white, then cream color, unchanging, rather close, rather broad, all simple to many forked, equal, often slightly ventricose, anastomosing, adnexed to adnate with decurrent tooth, spore print between B and C, but often slightly yellower in tone quality. — Stipe pink on white ground, subrugulose, equal, but sometimes with enlarged apex, 50—57 ⇌ 12—27 mm. — Context white, relatively thin, unchanging, taste mild, odor none.

Spores 7.2—12 ⇌ 6.2—8.5 μ, orn. 0.7—1 μ, of type IV, more rarely III b, occasionally some extremely faint lines forming an almost complete reticulation, few with rows of isolated spinules, and in some prints some spores with very short ridges (IV—II), or of type V or VI; oil droplet small or more often large; basidia 35—48 ⇌ 10.7—12.5 μ, 4-spored; macrocystidia 50—76 ⇌ 8—14.3 μ, "empty" or with granular contents, ventricose and sometimes with constrictions, or clavate, reddening in chlorovanillin and often long-appendiculate on edge, less appendiculate and with blue granules in chlorovanillin on the sides, therefore edge almost heteromorphous; epicutis of pileus hyphous without dermatocystidia, the bunches or fibrils forming the granules consisting of primordial hyphae with distinct incrustations, some hyphae slightly thickwalled in old caps, some pilose, no bluing bodies present in SV; covering of the stipe likewise without dermatopseudocystidia.

$FeSO_4$ on context of stipe reddish gray, rather weak and slow reaction. — Phenol on context rather quickly passing through "rose dawn", then "rose ash", then "Brazil brown", with more reddish zone in the stipe at times, and there eventually purple brownblack. — Phenolanilin on dried context of stipe deep and pure red. — Formalin without reaction. — HCl on surface of pileus no reaction. — Chlorovanillin on stipe no reaction.

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Under oak and in oak-beech-woods on the ground, fruiting in summer in the northern, in late fall in the southern part of its area. Massachusetts to North Florida.

Material studied: *Mass.*: Mt. Wachusetts, 1800 ft elevation, Singer, FH. — *Fla.*: Types of *R. roseitincta* and *R. subgranulosa,* both from Alachua Co., FLAS.

This species is somewhat intermediate between *R. subfloridana* and *R. pulchra,* showing the sporal and cystidial characters of the latter, but having a light cream colored spore print. The spore print color is similar to that of *R. lepidiformis* but the species differs in being less hard and compact, and in having absolutely mild taste. Both of Murrill's species are very much like our collections, and they are also very similar to each other having been collected the same day of the year. The stipe of *R. roseitincta* is still beautifully pink; *R. subgranulosa,* type, is apparently an old, somewhat bleached and discolored form but has the granulation of the pileus surface better preserved while in the type of *R. roseitincta* no traces of granulation are visible, a condition often found in rain-washed material. We have never found lilac tones in the center of the pileus, and believe this to be an atypical condition. The identification of this species was possible because of a good spore print accompanying the type. Without a spore print, the species is very difficult to distinguish from *R. pulchra* and *R. subfloridana,* especially in the field. This may also be true for *R. hixsonii* which differs from *R. roseitincta* in taste, slightly deeper colored spores, and a few minor characters.

Russula subfloridana Murr., Lloydia **8**: 271. 1945 (1946).

Pileus bright (rosy) red "spring time", "flirt", "jasper pink" "raspberry red", "coral bell" and paler (to "Persian melon"), M&P, with ochraceous hues intermixed (a color like pl. 3 A 11, M&P resulting), the ochraceous hue becoming more obvious in dried material in the center, subpruinose at the margin, the latter smooth but eventually, becoming sulcate, with broadly rounded margin, viscid in weather but drying out rapidly, with the cuticle separable over one third of the radius, convex, then applanate with slightly to distinctly depressed center, 22—110 mm. broad. — Lamellae white, but pale cream color to cream when mature, unchanging, even when bruised, close, anastomosing, equal, rather plane, medium broad (4—9 mm.), some bifurcate at the stipe but otherwise simple, attenuate-subfree to attenuate-adnexed; spore print D (Crawshay). — Stipe "pink pearl rose hermosa" M&P, or rarely white, smooth to rugulose, short (shorter than the diameter of the pileus), or elongate, equal or tapering upward, solid or stuffed, 24—64 ⇌ 7—17 mm. — Context white, unchanging on injury, fragile; taste mild; odor none.

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Spores 7.5—10.2 ⇌ 6—8.2 μ, orn. of type IV or III b, in fewer spores V, frequently with chains (VI—VIII) or curved rows, short ridges (IV—II), very few occasionally VI, projecting 0.6—0.9 μ; basidia 23.5—36 ⇌ 8.2—11.7 μ, 4-spored but occasionally 1-, 2-, 3-spored ones intermixed; cystidia 27—55 ⇌ 7—9.2 μ, "empty" or granular inside, with or without a 1—14.3 μ long appendage, usually clavate or subclavate, but often acute at the very apex; subhymenium strikingly thin, consisting of moderately small cellular elements; hymenopodium very broad, well developed consisting almost entirely of strongly elongated to filamentous elements; epicutis of pileus consisting entirely or almost entirely of ordinary thin filamentous hyphae which are ascending and imbedded in a small quantity of gelatinous masses, forming a rather thin layer, completely devoid of any sort of cystidia or pseudocystidia, but rarely a few hyphae with crowded septa, others with inflated portions; hypodermium much denser, conspicuously intermixed-interlaced with a general cutis-structure; pigment of the hypodermial elements pink, dissolved, intracellular, unstable, soon disappearing in ammonia mounts.

$FeSO_4$ on context of stipe reddish salmon gray, more reddish orange in cortical layer, more gray in interior of stipe. — Phenol on context reddish brown, then chocolate. — Anilin on lamellae sulphur yellow, becoming glaucous after a while. — KOH on pileus surface deep ochraceous yellow.

In low hammock vegetation and nearby, always under *Quercus,* on the ground, in groups, fruiting from April until July and probably until November. North Florida.

Material studied: Alachua Co., Sugarfoot Hammock, July 9, 1943, Singer F 2665, FH.

The type has not been studied by this author, but the original description of no. F 18067 FLAS (type) leaves little doubt as to the identity of the species. It was collected one year later, not far from the locality where the material described above was gathered. Were it not for Murrill's description of the color of the pileus of *R. subgranulosa,* one might also assume this latter to be identical with the same species.

Russula pulchra Burl., Mycologia **10**: 95. 1918.

Pileus bright rose red to scarlet red, nopal red toward the margin in some specimens, or peach red in the center, opaque, finely granular-subvelutinous or subvelutinous-fuzzy, occasionally rimulose in age except in the center, somewhat viscid when very wet but drying rapidly, with smooth, eventually tuberculate-sulcate rounded margin, convex, often with a slightly depressed center or applanate, 68—88 mm. broad. — Lamellae white, sometimes becoming slightly creamy with age, unchanging when bruised, moderately broad to

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broad (7—10 mm.), not ventricose or slightly ventricose, some lamellulae forking from the through-lamellae at half-breadth or all equal and simple, but sometimes bifurcate at the stipe, mostly distinctly anastomosing, close to subdistant, broadest in the marginal third, adnexed and often subdecurrent with a tooth on one side, or adnate all around; spore print white, between A and B, or nearly A, not reaching B (Crawshay). — Stipe white, with or without some yellow spots near the base, subrugulose, glabrous, solid, but soon soft-stuffed to spongy-hollow, 46—70 ⇌ 13—20 mm. — Context white, unchanging, fragile; taste mild; odor none.

Spores 8—11.7 ⇌ 6.5—10.2 (11) μ, orn. 0.7—1.7 μ, of type VI, V, IV, some III b, but usually with extremely fine, hardly visible connecting lines which form an indistinct interrupted network, some spores with short rows (IV—VIII); basidia 34—45 ⇌ 11—14.3 μ, 4-spored, clavate; cystidia of the macrocystidium-type, bluing with chloro- and sulfovanillin at least on the sides of the lamellae (on edge sometimes remaining carmin red or brownish and there more frequently appendiculate), 45—70 ⇌ 9.5—12.3 μ, fusoid to ventricose or clavate, with granular to banded contents all through or in a large portion of the interior, some conspicuously appendiculate (appendage 8 μ to extremely long on the cystidia of the edges), scattered on the sides of the lamellae; edge subheteromorphous or homomorphous; hymenophoral trama with very numerous and large spherocysts which are not sharply separated from the smaller spherocysts of the subhymenium; epicutis of pileus consisting of hyphae with extremely variable diameter (1—8.8 μ), hyaline, without incrustation and contents, in SV without any bluing bodies, although some are apparently primordial hyphae, no oleiferous hyphae seen; hypodermium formed by a cutis of filamentous hyphae with some spherocysts mixed in, all filled with the dissolved intracellular pinkish pigment (NH_4OH), without oleiferous hyphae; covering layer of stipe formed exclusively by filamentous hyphae of 2—4 μ diameter, dermatopseudocystidia and oleiferous hyphae none; all hyphae without clamp connections.

$FeSO_4$ on context of stipe pale grayish pink. — Phenol on context chocolate.

On the ground under *Quercus* in woods, fruiting from July until September in New England and south to Virginia.

Material studied: *Mass.*: Stow, Davis, MICH, type. — Boston Myc. Cl. Herb., FH, and NY, paratype. — Mt. Wachusetts, Singer FH. — *Va.*: Mountain Lake, Giles Co., Singer, FH.

Russula australirosea Murr., Lloydia **8**: 264. 1945 (1946).

Pileus when young and fresh varying from "jasper red" and "old rose" on the margin to "Vandyke brown" and "Hays's maroon"

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in the center, sometimes partly, "pompeian red" (R.), pallid specimens merely pinkish and breaching on drying ("subroseous, become subavellaneous with a rosey tint" on drying according to Murrill), subviscid, drying out rapidly and becoming opaque when dry and when dried, even somewhat subvelutinous, with the cuticle separable over three quarters of the radius, with obtuse to broadly rounded margin (at first obtuse but not distinctly rounded), smooth, in larger caps soon but indistinctly sulcate, 38—75 mm. broad. — Lamellae white, unchanging, equal or intermixed with some shorter ones, medium broad to broad (4—10 mm.), sometimes many bifurcate at the stipe, adnate-subdecurrent and narrowed to the stipe, moderately close to close; spore print C to D (Crawshay). — Stipe white, in age often sordid-vitreous, glabrous, smooth or subrugulose, subequal, solid, then stuffed and somewhat hollow, 23—35 ⇌ 10—17 mm. — Context white, unchanging, firm, then fragile; taste mild; odor slight, fruity.

Spores 8.8—10.5 ⇌ 7.5—9.3 μ, orn. 0.8—1 μ, sometimes 0.7—1.3 μ, of type III a, with few to fairly numerous spores showing ridges (II) and a minority with orn. III a; basidia 34—48 ⇌ 8.2—14.5 μ, clavate, extremely variable in size, 4-spored or a few 2-spored ones intermixed; cystidia of the macrocystidium-type or "empty", always some present with scattered to rarely dense banded contents, versiform, rather easily collapsing, appendiculate or not, 50—65 ⇌ 6.5—10 μ, moderately numerous; epicutis of pileus consisting of hyaline filamentous hyphae which are loosely arranged, with some pilose terminal members, the latter sometimes dermatocystidioid but "empty" or with some scattered granules, always without banded contents, occasionally somewhat incrusted.

Under oaks in low hammocks, fruiting from June until September. North Florida.

Material studied: Alachua Co., near Newnans Lake, Murrill F 38859, FLAS, type. — Sugarfoot Hammock, Singer F 2546, FH (sub nom. "*R. vinosirosea* Murr.?").

This species is in appearance rather similar to *R. vinosirosea* Murr. and it was at first believed that F 2546 belongs to the latter. Characteristic features are the completely mild taste, lack of dermatopseudocystidia on the pileus. It not only varies considerably as far as intensity of pileus pigmentation and size are concerned but, at the same time, seems to be rather rare. Unfortunately, the chemical characters of *R. australirosea* are still unknown, but there seems to be no doubt as for its position outside the subsection *Xerampelinae*. There is no discoloration and no odor even in old drying material.

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Subsection *Lepidinae* Melzer & Zvára.

Russula sericeonitens Kauffm., Rep. Mich. Acad. Sc. **11**: 84. 1909.

Pileus "Hay's maroon" to "madder brown" R. (lilac purple), deeper to blackish in the center, shining, with entirely separable cuticle, with smooth subobtuse margin which may become slightly striate in age, convex, later variously applanate or depressed, 40—90 mm. broad. — Lamellae white, moderately broad or broad (e. gr. 9 mm.), broadest in outer third, narrowed toward the stipe where they are often bifurcate, equal, close to crowded; spore print pure white (A, Crawshay). — Stipe white, smooth or rugulose, glabrous, equal or tapering in the lower two thirds, 30—70 ⇌ 10—15 mm. — Context white, unchanging, rather firm, then spongy; taste mild; odor none.

Spores 8.3—9.8 ⇌ 7—8.5 μ, orn. 0.8—1.5 μ, of type VI; basidia 33—43 ⇌ 10.6—11.8 μ, 4-spored; cystidia with dispersed granular to banded or amorphous contents, especially in the middle of the cystidia those with banded contents bluing in SV, the others pink, versiform, clavate, cylindrical, fusoid, irregularly ventricose, sometimes with constrictions, often appendiculate, appendage e. gr. 5.5 μ long, moderately numerous, 33—56 ⇌ 5.5—10.3 μ; epicutis of pileus consisting of ascendant to erect hyphal ends which are filamentous or occasionally swollen, the swollen parts of the filamentous portions often with scattered to dense contents (blue in SV), but the pseudocystidial bodies not typical in shape and very scattered, other hyphal ends not bluing and with incrustations instead, the bluing ones 2.7—7 μ and the incrusted ones 1.5—5 μ in diameter; covering layer of stipe with clavate dermatopseudocystidia with sparse contents, not very numerous, 5—9 μ in diameter; oleiferous hyphae also present.

$FeSo_4$ on context of stipe grayish salmon. — Phenol on context „russet vinaceous", with darker areas ("liver brown", R.).

Under various frondose trees, often in mixed woods (*Quercus, Betula, Carpinus* etc.) on the ground in moist places, fruiting in summer and fall. From New England south to Pennsylvania and west to Michigan.

Material studied: *Mass.*: Harvard, September 24, 1944, Singer, FH. — *Pa.*: Mt. Gretna Park, Kauffman, MICH, authentic material. — *Mich.*: Houghton, Kauffman, MICH, type.

Russula perplexa Burl., Mycologia **10**: 96. 1918.

Pileus "acajou red", "dragon's blood red", "salmon buff", mixed with "amaranth purple" in the center, "apricot yellow" to "coral

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pink" elsewhere according to Burlingham, usually pink or red, finely granular-pruinate but viscid when wet, drying rapidly, with rounded smooth morgin, eventually sometimes with sulcate margin, with the cuticle separable almost to the center, opaque when dry, convex, soon depressed in the center, 40—70 mm. broad. — Lamellae white, equal, simple, close to crowded, broadest in the outher third, attingent-subfree but becoming somewhat decurrent in age; spore print white. — Stipe white, somewhat pink or almost entirely pink, glabrous or almost so, smooth to rugulose, solid, then stuffed-hollow, versiform, 40—78 ⇌ 4.5—9 mm. — Context white, unchanging; taste mild; odor insignificant or none, according to Burlingham sour when drying.

Spores 9.3—12.3 ⇌ 7—10 µ, predominantly large, orn. 0.1—1.8 µ, the ling spines being characterstic, type VI or IV, fewer V, few III b, often some with short ridges (IV—VIII, III b, VIII); basidia 28—38 ⇌ 11—12 µ, clavate or ventricose, short or elongated, 4-spored; cystidia of the macrocystidia-type, with densely packed or loose banded contents, 52—85 ⇌ 8—13 µ, ventricose or fusoid, acute or rounded above, sometimes mucronate, yellow or hyaline, rather numerous on the sides of the lamellae; edges subheteromorphous with very crowded macrocystidia of the same kind; epicutis of pileus with at least fairly numerous dermatopseudocystidia with banded contents, clavate or fusoid, mostly with rounded apex, long, non-septate, 60—126 ⇌ 4—8.5 µ, otherwise epicutis made up by hyphae which form a loosely (because of gelatinisation) arranged trichodermium.

Phenol: "russet vinaceous" with "vinaceous brown" (R.) spots where pressed.

On the ground in moist places of the woods under *Pinus strobus* and *Picea rubra,* also under other pines and hemlock (*Tsuga canadensis*), often in mixed woods in low places, fruiting from summer until fall, mostly in July and August. From New England south to the mountains of Virginia. Western limits unknown.

Material studied: *Mass.*: Davis, Boston Mycol. Club Herb. at FH, NY, parts of type. — Harvard, Singer, FH (very near the type locality). — *N.H.*: Petersborough, Singer FH. — *Vt.*: Frost (as *R. mariae,* but possibly this), FH. — *Va.*: Mountain Lake, Giles Co., Singer FH.

R. perplexa differs from *R. peckii* in the presence of typical dermatopseudocystidia on the pileus rather than merely bluing hyphal ends. In the latter character, *R. peckii* is closer to *R. nothofaginea* Sing. from Patagonia and Tierra del Fuego. Formerly, it was thought that the spores also offer a means of differentiating between the two North American species, but some specimens of *R. peckii* (in the same print) vary to type IV, V, VI and the height of the spines varies from 0.6 to 1.6 µ so that there is no sound basis

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for separating the two Russulas on that basis. *R. peckii* is common under conifers from New England (Vermont) and New York to Virginia and Tennessee.

Subsection *Xerampelinae* Sing.

Russula xerampelina (Schaeff. ex Secr.) Fr. var. **semirubra** Sing. var. nov.

Syn.: *Russula floridana* Murr., Bull. Torr. Botan. Cl. **67**: 57. 1940.
Russula praerubriceps Murr., Lloydia **6**: 214. 1943.
Russula levyana Lloydia **7**: 311, 1944 (1945).

Pileus "coral red", "Eugenia red", "acajou red" sometimes partly "Corinthian red" to blackish red, the deeper tones more concentrated in the center, the brighter ones on the margin, often pinkish red all over (as in *R. emetica* ssp. *emeticella*) but not very glabrous and scarcely shining, more opaque and unpolished, even slightly roughened or subvelutinous to subpunctulate-pruinate at times, often fading and then showing some "chartreuse yellow" or "colonial buff", the pellicle not readily separable or separable only part way from margin, with obtusely rounded margin which is smooth or more rarely somewhat sulcate in age, convex, then somewhat depressed in the center, 40—80 mm. broad. — Lamellae white, then cream color, adnate, mostly equal or subequal, close to subdistant, simple or almost so but usually bifurcate at the stipe, medium broad to broad (4 mm. and more broad); spore print C (Crawshay). — Stipe white, staining slightly brownish where injured or handled, equal or subequal, sometimes with broadened base, or tapering downwards, solid, then stuffed, or finally stuffed-hollow, 30—80 ⇌ 8—20 mm. — Context white, staining brown where cut or bruised, but often slowly and inconspicuously discoloring; taste mild; odor none as long as quite fresh, but when old and drying typically of trimethylamine.

Spores 9.3—13 ⇌ 7.3—10.2 µ, orn. 0.8—1.8 µ high, of type III b, IV, a variable (sometimes considerable) number of type VI and V but then usually with extremely fine almost "negligible" connecting lines, many spores with short ridges (type IV—II), most frequently of type IV, wall yellowish in NH_4OH; basidia and cystidia as in the other varieties, the macrocystidia about 11 µ broad, more frequently obtuse than acute, with banded contents, often with a short appendage, numerous; epicutis with a variable number of dermatopseudocystidia, normally with numerous bluing elements; with scattered to moderately dense banded contents, yellowish to hyaline inside, cylindric to clavate, 58—82 ⇌ 4—9 µ, with rounded or mucronate apex; acute to subacute terminal members of hyphae (up to 4 µ broad) often conspicuous and transitions towards primordial

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hyphae numerous; hypodermium formed by a cutis of filamentous hyphae filled with a bright pink dissolved pigment.

$FeSO_4$ on stipe of mature specimens and in context greenish gray to green-olive. — Anilin oil on context red. — Sulfo- and chlorovanillin on dried stipe negative.

In high and low oak woods, also in mixed woods under oak and pine, on the ground, fruiting from July until September, in Florida the year round.

Material studied: *Mass.*: W. Roxbury, R. & H. Singer & D. H. Linder, August 31, 1945, FH, type. — Wakefield, Singer, September 6, 1943, FH. — *Fla.*: Alachua Co., Kelley's Hammock, under *Pinus glabra, Quercus,* etc., July 14, 1943, Singer F 2719, FH, paratype. — Types of *R. levcana* (F 15859, FLAS), *R. floridana* (FLAS), and *praerubriceps Murr.* (FLAS). — Europe: Ukraine, Fastiv, Singer, July 1928, W.

Latin diagnosis: Pileo rubro; stipite albo; in quercetis et silvis mixtis.

This new variety of the polymorphous *Xerampelina*-complex is typically North American, and seems to be particularly frequent from Massachusetts south to Florida. In Europe we have seen this form only once, and then in company of *R. xerampelina* var. *quercetorum* (the oak race with purple pileus, more rarely brown, with white stipe). It was then believed that this is only a rare mutant, and no spore print was taken. This race differs from var. *rubra* in constantly white stipe and often lighter or brighter colors, less strongly developed odor, and habitat.

We find in Florida an additional variety, also belonging to *R. xerampelina,* bright red forms, which differs from var. *semirubra* in the color of the stipe (often with a pinkish red flush) and in consistently smaller spores with shorter ornamentation. This variety is still undescribed; it is preserved at the Farlow Herbarium under the name *R. xerampelina* var. *microsperma* Sing. ined.

Then is a tendency toward recognition of the various "races" of *R. xerampelina* as independent species. In this case, var. *semirubra* would become *R. floridana.* But we have avoided Murrill's epithet since Murrill has failed to obtain a spore print and does not indicate the chemical reactions ($FeSO_4$ and anilin).

Subsection *Pusillinae* Sing.

Russula incarnaticeps Murr., Bull. Torr. Bot. Club **67**: 277. 1940.

Pileus near "old rose" and "eugenia red", tending to become bleached, on the disc sometimes reaching "oxblood red" or "carmin", the margin often near "salmon color" with a "cream buff" middle

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zone in many cases observed between margin and disc, often also showing a mixture between "jasper red" and pallid, occasionally with ochraceous brown to deep red spots somewhat like in *Russula maculata,* in other specimens with "ochraceous tawny", "carrot red", or "Etruscan red" to "light coral red" center, opaque, but sometimes somewhat shining in the bleached places, slightly viscid when wet but drying rapidly, glabrous or subglabrous, the cuticle separable over about two thirds of the radius or entirely, with subobtuse to obtuse, later rounded margin which is smooth and eventually becomes tuberculate-sulcate, convex, usually soon extremely irregular in shape, 29—90 mm. broad (with the sulcate zone of the old specimens 2.5—7 mm. broad). — Lamellae white, then creamy white to cream color, eventually often with spots of "honey color", "clay color" or "raw sienna" (R.), simple or forked, rather broad to broad (4—6 mm. in smaller specimens) and usually more or less ventricose, anastomosing, equal or subequal, adnexed to subfree, close to subdistant; spore print between B and C, or reaching C, but not deeper than C (Crawshay). — Stipe white, unchanging, but the base sometimes "honey color", "clay color" or "raw sienna" R., glabrous and smooth, or slightly subrugulose, stuffed, subequal or subventricose or tapering upward, either shorter or longer than the diameter of the pileus, 23—65 ⇌ 4—20 mm. — Context white, unchanging, rather soft and brittle, mild in most collections but once moderately acrid in young lamellae; odor weak, fruity, or none.

Spores 7—11 ⇌ 6.8—8.8 μ, most frequently 8.7—9.5 ⇌ 7.5—8 μ, orn. 0.3—1.4 μ, most frequently 0.6—1 μ or 1—1.2 μ, of type IV to III b, sometimes III b, sometimes IV predominant, some with catenulate (VIII) or ridge rows (II—IV); basidia 40—45 ⇌ 10.2—14 μ, 4-spored; cystidia versiform, usually ventricose, either "empty" or with granular to banded contents and then almost entirely blue in SV, or with dark blue internal bodies all over, often appendiculate (appendage e. gr. 5 μ long), 40—85 ⇌ 6.5—11.8 μ, fairly numerous; epicutis of pileus consisting of filamentous thin hyphae which are hyaline and irregularly arranged, loosely dispersed, among them narrow, filamentous septate, dermatopseudocystidia, these blue in SV, with extremely versiform (ventricose, ampullaceous, clavate, cylindrical, etc.) terminal members with or without appendage, some of the non-appendiculate terminal members of the dermatopseudocystidia with strictly acute apex, others rounded, 27—41 ⇌ 3—7.5 μ; hypodermium consisting of a cutis of interwoven, dense, normal hyphae.

$FeSO_4$ on context of stipe, especially in the cortical layer, between "pale ochraceous salmon" and "light ochraceous salmon" (R.). — Phenol on context initially more than usually purple, then choco-

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late. — HNO_3 on pale portions of pileus bleaching them to white; on deep colored portions brighter and lighter.

On the ground under oaks in hilly woods and on sandy soil in hammocks, usually gregarious, rarely solitary, fruiting in summer and fall. Massachusetts and south to Florida, western limits unknown.

Material studied: *Mass.*: Cambridge, Singer FH. — Arlington, various collections from July until October, FH. — *Fla.*: Alachua Co., type of *R. incarnaticeps,* Murrill, FLAS. — Newnans Lake, Singer F 2643, FH.

This is very closely related to the *pusilla*-complex and might easily pass for one of the numerous forms entering it (see below) were it not for the comparatively pale spore print which seems to be as constant as the comparatively pale dull incarnate-pink to sordid salmon pileus which, in brighter colored collections, always shows some mixture with pallid or bleached areas.

Russula pusilla Peck, Ann. Rep. N. Y. State Mus. **50**: 99. 1897.
Syn.: *Russula operta* Burl., Mycologia **18**: 18. 1924.

Russula praepalustris Murr., Lloydia **8**: 269. 1945 (1946).

Russuia pinophila Murr., Journ. Florida Acad. Sc. **8**: 182. 1945.

All forms with dermatopseudocystidia (bluing in SV) not broader than 10 μ, spores partly or not reticulated, spore print between C and D, and constantly white stipe, with bright flesh red pileus and normal (grayish pink, not salmon color) $FeSO_4$ reaction are here inserted in *R. pusilla.* It is here assumed that all these forms are specifically identical, but since there might be an off-chance that an independent but very closely allied species is hidden in this "complex", or that varieties may be separable within the species, the descriptions are here separated according to the forms observed:

Description of the South Florida form: Pileus "jasper red", often appearing "light jasper red" because of the paler bloom, the center concolorous or with some "pompeian red" or rarely "madder brown" or "acajou red" or even "Vandyke brown", more rarely with some sordid olive brown color mixed in the center, varying from pruinate with a strong bloom to subpruinate, later glabrescent and at the same time often partially bleaching, viscid when very wet but drying out rapidly, always opaque when dry, smooth, later sulcate at the obtuse margin, convex, then depressed in the center or applanate to concave, 9—31 mm. broad. — Lamellae white, then light cream color, ordinarily equal or subequal and simple, or almost so, scarcely anastomosing to distinctly anastomosing, ventricose to subventricose, subdistant to more rarely crowded, attenuate-adnexed or adnexed with a decurrent tooth or rounded-adnexed; spore print D (Crawshay), not paler. — Stipe white (com-

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pletely and purely white), unchanging, subrugulose, equal or tapering upwards, soon becoming hollow, 15—65 ⇌ 4—9 mm. — Context white, unchanging, fragile; taste in young lamellae usually slowly and moderately acrid and slightly bitter in many cases, later mild; odor none.

Spores 8.2—11 ⇌ 6.8—8.8 μ, mostly about 9—10 μ long, orn. (0.5)—0.8—1.4 μ, mostly 0.8—1.2 μ, of type IV, V, VI, fewer III b, with extremely thin connecting lines but some spores always with short ridges (IV—II), the spines cylindrical and slender; cystidia of the macrocystidia-type, with yellowish banded contents, moderately numerous (about 6—8 in an area of 200 μ square), versiform, most frequently ventricose; edge of lamellae homomorphous; epicutis of pileus consisting of non-incrusted hyphae with rounded or acute tips, hyaline, hyphae about 2.5—2.6 μ thick with up to 0.5 μ broad walls, with dermatopseudocystidia (blue in SV) also present, with banded contents, yellow, clavate, up to 9 μ broad, also large oleiferous hyphae with banded contents; hypodermium with dissolved intracellular pigment, with hyphae forming a cutis.

$FeSO_4$ on context of stipe rather pale sordid gray. — Phenol on context of stipe slowly sordid gray, then "cameo brown" and "chocolate" (R.). — KOH on pileus bright red. — HCl on pileus negative, after long exposure brownish.

On calcareous ground and on very rotten wood in tropical hammock and under pines and oaks, usually in groups, from September until October in South Florida.

Material studied: Dade Co., Brickell's Hammock, Singer F 904 a, — Fairchild Tropical Garden, Singer F 1392, FH.

Description of the Florida summer form I (outside the calcareous zone): Pileus "jasper red" with "light jasper red" R. margin, or "Mephisto" (M&P), farther inside with a blackish shade that makes the pileus very deep red (impossible to match), in paler forms pl. 2 H 9—10, I 9—10, J 9—10, reaching K 10 "Geranium" (M&P), subvelutinous or somewhat pruinate, never seen viscid but probably viscid in very wet weather, with the cuticle peeling over half the radius, with smooth or sometimes subrugulose surface, with rounded-obtuse margin which is smooth but usually becomes sulcate over a zone 2—7 mm. broad, convex then applanate, or convex with narrowly depressed center, eventually concave, 16—41 mm. broad. — Lamellae cream color, broad, anastomosing, free, crowded to subdistant; spore print varying from C (F 263) to D (North Florida). — Stipe entirely white and unchanging, shorter or longer than the diameter of the pileus, glabrous and slightly rugulose, stuffed then hollow, versiform but usually subequal or tapering upwards, 16—35 ⇌ 2—11 mm. — Context white, unchanging, fragile; taste

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usually mild, but moderately acrid in young lamellae in very fresh material; odor none.

Spores 7.8—11.2 ⇌ 7.5—9.5 μ, orn. 0.5—1.7 μ, most frequently about 1 μ, of type IV, III b, more rarely some short ridged (IV—II), very few spores with orn. V, VI, or III a, in some specimens numerous abnormal spores present (strongly elongated or smooth, IX, etc.); basidia 32—38 ⇌ 10.5—12.5 μ, clavate-ventricose, 4-spored; cystidia of the macrocystidia-type, bluing at least in half their length in SV, with abundant banded contents, fewer with little banded contents mainly in the middle region, versiform, often ventricose or ampullaceous, 50—60 ⇌ 10—11.5 μ, frequently short appendiculate; edge of lamellae slightly to decidedly subheteromorphous, i. e. with considerably more macrocystidia at the edges than on the sides of the lamellae; epicutis of pileus consisting of hyphae with numerous yellow clavate dermatopseudocystidia (bluing in SV) interspersed, these sometimes acute, more frequently broadly rounded, sometimes mucronate, 4.5—9.5 μ broad, in their majority non-septate, but some with 1—2 septa.

$FeSO_4$ on context of stipe sordid gray. — Phenol on context normal chocolate or chocolate mixed with fawn color (North Florida). — KOH on surface of pileus deep brownish yellow.

On the ground or (in low hammocks also) on trunks of *Sabal palmetto,* solitary or in groups, probably always near oaks (*Quercus laurifolia* and *Q. virginiana*), fruiting in summer. Alachua to Highlands Co., Fla.

Material studied: Alachua Co., Gainesville, in high hammock, Singer F 2774, FH. — Highlands Co., Highlands Hammock State Park, in low hammock, often on palms, Singer F 263, F 168, F 168 a, etc., all FH.

This form may be in itself heterogeneous, with the Highlands Hammock State Park collections constituting a form with pale spore print, smaller carpophores, and uniformly chocolate phenol reaction.

Description of the Florida summer form II. Pileus "pirate", "confetti", "coral red", "candy pink", "baby rose", etc., (M & P) to A 10 (M & P, same plate), but in young specimens often with tones like "troubadour r." intermixed with "jasper red", "coral red", "nopal red" (the latter three of R.), intermixed with "eugenia red" (R.), or paler, viscid in wet weather, drying out rapidly, glabrous, smooth except for the (2—6 mm. broad) sulcate margin which is subsmooth when young and obtuse but not broadly rounded, with a cuticle which is shining when wet and opaque when dry and peeling over one half of the radius, convex, becoming umbilicate, eventually concave and umbilicate, 25—45 mm. broad. — Lamellae white, in age a very light ochraceous yellow, narrow or broad

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(3—6 mm.), anastomosing, rather close, soft, subequal or equal, simple and not bifurcate at the stipe, adnexed; spore print from between C and D to between D and F (Crawshay). — Stipe entirely pure white, unchanging, subrugulose, glabrous, stuffed, then spongy-hollow, subequal or tapering upward or downward, 35—55 ⇌ 4—15 mm. — Context white, unchanging, thin fragile; taste moderately acrid in young and very fresh lamellae, otherwise completely mild; odor none.

Spores 8.2—11 ⇌ 7—7.7 μ; orn. 0.7—0.9 μ, of type IV, III b, more often IV, some with short ridges (IV—II) or catenulate (III b—VIII), the spines often regularly arranged and rather spaced or intermixed with minute granular warts, the connecting lines usually extremely fine and therefore easily overlooked, but some short ones sometimes thick; basidia 32—41 ⇌ 8.2—11.6 μ, ventricose-clavate, 2—3- and 4-spored (not differing in size according to number of sterigmata); cystidia of the marcrocystidia-type, with yellowish banded contents especially in the middle portion, appendiculate or more often non-appendiculate and rather versiform, usually ventricose, moderately numerous, not more numerous on the edge of the lamellae, 46—55 ⇌ 8.2—11 μ; subhymenium cellular but not sharply divided from the hymenopodium which consists of thin filamentous hyphae and is well developed; hymenophoral trama with numerous spherocysts, but connective hyphae also numerous; epicutis of pileus consisting of an ixotrichodermium of filamentous wavy hyphae which are essentially upright and imbedded in a gelatinous mass, the latter not very abundant; dermatopseudocystidia also intermixed with the hyphae of the epicutis, of the macrocystidia-type, some of them continuous and very long, others repeatedly septate as in *R. sphagnophila,* up to 85 μ long, 4—9 μ broad; hypodermium consisting of filamentous hyphae, the majority of which is suberect or ascending, not intermixed with spherocysts, with bright pink dissolved intracellular pigment which bleaches rapidly in ammonia mounts; covering layer of stipe consisting of a heteromerous tissue with fewer spherocysts and more numerous connecting hyphae than in the context underneath, also with moderately numerous dermatopseudocystidia with yellow contents (blue in SV), usually with rounded tips, with the same size and shape as those of the epicutis of the pileus; hyphae without clamp connections.

$FeSO_4$ on context of stipe pale grayish reddish. — Phenol on context chocolate. — Anilin with lamellae between "marguerite y." and "primulin y." R. — KOH on surface of pileus yellow (not lemon yellow). — HNO_3 on surface of pileus bleaching the pigment to light lemon yellow but soon red again.

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On the ground in high hammock in association with *Boletus flavissimus,* evidently connected by a mycorrhizal relationship with *Quercus virginiana* or *Q. laurifolia* or both, fruiting from May until July, probably also until fall.

Material studied: Alachua Co., Gainesville, Singer, F 2608, FH.

Description of the Florida winter form: A detailed description of the winter form cannot be given, but for some data see under notes on *R. pusilla,* below. Both *R. praepalustris* Murr. and *R. pinophila* fall into this category.

Description of the northern form: Pileus "old rose", with a tinge of "eugenia red" (R.) or brighter red as *R. emetica* ssp. *emetica,* often with pale spots or pallid ground, sometimes with much darker, almost blackish center, often as red as *R. integra* (*R. velenovskyi*), rarely more like *R. vesca* in color, center of those specimens without a dark disc often bleaching to whitish or pale buff, more rarely bleaching in the marginal zone, always opaque, never shining under normal conditions, glabrous to very faintly pruinate or subvelutinous in the marginal zone, especially when quite young, glabrescent when old, with the cuticle varying from difficult to separate even in the marginal zone to well separable except in the darker center (where such is present), with more or less rounded margin which is smooth, later short-sulcate, convex, with depressed center, eventually sometimes applanate or concave, 20—65 mm. broad, mostly 23—35 mm. — Lamellae white, then cream white and pulverulent, or cream color with paler dusted spots, subclose to close, more rarely moderately close, rarely crowded, somewhat to strongly anastomosing, rather broad to broad (about 4 mm.), equal and simple, narrowed toward the stipe and attingent-adnexed, sometimes sinuate or subfree or almost adnate-subdecurrent; spore print varying from C to between C and D, perhaps reaching D (Crawshay). — Stipe white, sometimes at the base yellowish salmon or sordid pallid, but unchanging on handling, slightly rugulose, often tapering downward and attenuate at the very base, sometimes equal or tapering from the apex to the base, stuffed-spongy, 20—36 ⇌ 3—13 mm. — Context white, unchanging; taste mild except for the very fresh young lamellae which are weakly acrid, basides often very slightly bitterish (but not constantly so); odor none or rarely like that of *Scleroderma aurantium* and *Russula nauseosa.*

Spores 8.5—11 ⇌ 6.5—9 μ, orn. 0.7—0.9 μ, of type IV, V, more rarely VI, sometimes also many spores III b, the connecting lines short and very fine, varying from easily visible to hardly visible in oil immersion in iodine medium; basidia e. gr. 30 ⇌ 10 μ, 4-spored; cystidia of the macrocystidia-type, with loosely banded contents and bluing in SV, 53—68 ⇌ 8.5—13 μ, cylindric-fusoid, sometimes appen-

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diculate; epicutis of pileus consisting of hyphae and some of these somewhat pilose and acute in the terminal cell, dermatopseudocystidia of the macrocystidia-type also intermixed, varying from scattered to numerous (if scattered, often septate, if numerous often narrow), fusoid to more often clavate, 5—8,5 μ broad.

On the ground in woods, mostly oakwoods, also in *Fagus-Tsuga* stands, and under *Quercus*, *Fagus*, and other frondose trees in mixed stands (with *Pinus*, *Tsuga*, etc.), often in hilly places, fruiting from late spring until fall, most commonly in summer.

Material studied: *N. H.*: Mount Chocorua, Piper Trail, Linder & Singer, FH. — *Vt.*: Newfane Hill, Kelly Mycological Herbarium, MICH, type of *R. operta* Burl. — *Mass.*: Harvard, Singer, FH. — *N. Y.* Bronx Park, Kieffer, det. Singer (fresh), NY. — Van Cortland Park, Singer, NY. — Ibid., Earle & Murrill (as *R. uncialis*), NY. — Port Jefferson, Peck, NYS, type of *R. pusilla* Peck. — *Tenn.*: Great Smoky Mountains National Park, trail from Indian Gap to Chimneys, Hesler & Sharp, det. Singer, FH.

This latter form may be subdivided in one that shows no deep purple or blackish tones on the disc, somewhat larger in an average, with fewer and more septate dermatopseudocystidia, growing commonly in mixed oakwoods (with *Quercus* as apparent mycorrhiza partner), and another form, often associated with *Tsuga* and the frondose trees growing with it in the mountain woods of New England, with more numerous and typical dermatopseudocystidia and more frequently purple or black center, with the average size perhaps slightly smaller than in the other form. The latter form would coincide with *R. operta* Burl. Nevertheless, there are intermediate forms such as a collection from Tennessee, showing the entire range in color and size in a single population whereby the microscopical characters are intermediate.

The Florida winter form is also appearing in a larger and a smaller "subform", one represented by the type of *R. praepalustris*, the other by the type of *R. pinophila* Murr. Since no fresh collections were made by the author, no opinion is given as to the actual range in size, and it may well be that the two species are merely extremes in size. Murrill indicated pine as accompanying tree in both cases, but everybody acquainted with field observations on mycorrhizal relationships in that region is aware that these observations merely refer to the nearest conspicuous tree, not to other trees within the 10 m. radius, and not to the occurrence of dwarf oak in the flatwood just east of Gainesville. The identification of the two species depends, of course, on the correctness of Murrill's indications regarding the spore color since we have not seen a print. The color of the lamellae would indicate, in scratch samples, and by comparison with

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other specimens of *R. pusilla* that there is no difference in the spore color of these species and the summer forms. In the type of *R. praepalustris,* the spores are 8.2—10.2 ⇌ 6.8—8.2 μ, orn. 0.4—0.9 μ, its type extremely variable on lamellae, mostly IV, IV—II, III b, rarely VI, II, VIII, IX, some gigantic spores (12.3 ⇌ 9.5 μ) observed, some spores with the spines arranged spirally as in *Laccaria echinospora;* dermatopseudocystidia without crowded septa with loose banded contents, fairly numerous on surface of pileus and stipe, 6—8.8 μ in diameter. The larger of the two types, that of *R. pinophila,* F 17982, FLAS, is now fulvous-rufescent; the habit is that of a small *R. integra*; the stipe is still white all over; the lamellae are anastomosing, moderately broad, subclose; the margin of the pileus is subsmooth on one side, subtuberculate on the other, either subobtuse or rounded. The general appearance is very suggestive of *R. admirabilis* somewhat washed out by rain, especially because the latter species is so common in winter under pines. But the spores are not deeply colored enough, and they are actually indicated as being white by Murrill which can hardly be true since they are distinctly yellowish under the microscope and in scratch samples from the lamellae. Spores of type 8.8—11 ⇌ 7.7—9.2 μ, occasional gigantic spores up to 12.7 ⇌ 10.3 μ, orn. 0.3—1.4 μ, of type III b, IV, V, rarely VI or IV—II; basidia 38—52 ⇌ 11.5—16.7 μ, 2-3-4-spored, mostly 4-spored, strikingly large; cystidia 44—94 ⇌ 6.8—12.5 μ, moderately numerous on the sides and edges of the lamellae (edges homomorphous), fusoid or ventricose, more frequently acute than obtuse, more frequently appendiculate (1—10 μ long) than not, rarely with a constriction below the apical portion but never ampullaceous, deep-rooting, the tip from about 20 μ below the level of the sterigmata to about 40 μ above it, with distinct banded contents; dermatopseudocystidia on both the pileus and the stipe rather long with occasional septa, rather narrow to rather broad, connected with some oleiferous hyphae which are opalescent and melleous. The contents of the dermatopseudocystidia is variable, more often banded than not, and then loosely stuffed. Murrill's description of the cystidia is completely erroneous.

There are several species within this subsection which are extremely close to *R. pusilla.* One of them is *R. humidicola* Burl. which the author has (1) redescribed in his type studies. It differs in a slightly aberrant color of the pileus, in an average of a few decimals lower in the fraction of pileus diameter, stipe length, and in the $FeSO_4$ reaction. Another such species is *R. subpusilla* Murr., Mycologia **33**: 285, 1941, syn.: *R. alutaceiformis Murr. Lloydia* **6**: 210. 1943. Even when reading the two descriptions given by Murrill, one is at a loss as to their differentiation as species. The types were examined and found to be extremely similar to forms of

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R. pusilla, and coinciding with that species in every particular except broad (3.5—11.7 μ, mostly 10—10.5 μ in diameter) dermatopseudocystidia which have coarsely banded contents. No fresh material was available, but on the basis of the broad dermatocystidia it might well be possible to conserve *R. subpusilla* as a separate species.

Russula cystidiosa Murr., Bull. Torr. Bot. Cl. **67**: 145. 1940.

Syn.: *Russula subfragiliformis* Murr., Lloydia **6**: 217. 1943.

Pileus near "jasper red" and "nopal red" (R.) but brighter colored than both, paler in the marginal portion, rarely more pinkish red all over (like *R. aurora*), very slightly subvelutinous, subviscid when wet but drying very rapidly, with obtuse to rounded margin, at first smooth everywhere, later with short-sulcate (2—6 mm.) margin, convex, then applanate or concave, always with depressed center, 50—110 mm. broad. — Lamellae white, later cream color, rather narrow to broad (5—10 mm.), close to subdistant, subrounded-subfree, attenuate toward the stipe, anastomosing, simple and equal; spore print D, or slightly deeper (yellower) but not reaching E in intensity (Crawshay). — Stipe white, in every population at least some if not all specimens flushed with more or less pink, glabrous to very slightly pruinate-scurfy, smooth or somewhat rugulose, solid, then stuffed or hollow, subequal, 38—70 ⇌ 10—22 mm. — Context white, unchanging, somewhat reddish underneath the cuticle, reddish when the cuticle is peeled, rather firm, eventually spongy to fragile; taste mild except in very young and fresh lamellae where it is weakly acrid, at times also very slightly bitterish; odor none.

Spores 7.5—11.7 ⇌ 7—10.2 μ, orn. 0.7—1.7 μ, of type VI or IV, sometimes VI, sometimes IV predominant, more rarely IV—II, V, very rarely a few III b; basidia 36—58.5 ⇌ 11—16.7 μ, i. e. voluminous, clavate or more frequently ventricose-clavate, 4-spored; sterigmata long (about 10 μ); cystidia of the macrocystidia-type, numerous and conspicuous both on the sides and edges of the lamellae, 50—116 ⇌ 6.8—13.3 μ, with strongly banded contents almost all over or sometimes some with homogenous contents or a few "empty", hyaline to yellow, mostly acute and non-appendiculate, more rarely obtusely rounded, or appendiculate, in other individuals the majority appendiculate, ventricose in the upper third; subhymenium subcellular; hymenopodium distinctly more filamentous; edge of lamellae subheteromorphous to alsmost homomorphous; epicutis of pileus consisting of a trichodermium made up by hyphae which are often fasciculate forming strands of peg-like formations, making the surface of the pileus slightly roughened under a lens, smoothed down to a tangential position in age or after rains and then epicutis a very thin layer,

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dermatopseudocystidia numerous, clavate, ventricose or fusoid, rounded above, 5.5—12.2 μ broad, usually non-septate, or with a few distant septa, often originating from oileiferous hyphae; terminal members of epicuticular hyphae often very acute and somewhat pilose; hypodermium consisting of a denser layer of filamentous hyphae forming a cutis, filled with very bright pink intracellular and dissolved pigment which becomes diffused over the entire preparation and fades very rapidly in ammonia mounts; covering layer of the stipe with innumerable dermatopseudocystidia, 30—65 ⇌ 5.3—11 μ, clavate, with banded contents, without appendage.

Chlorovanillin on fresh and dried stipe negative.

On the ground, usually in groups, more rarely solitary, under *Quercus* in low and mesophytic hammocks, fruiting in summer. Florida.

Material studied: Alachua Co., types of *R. cystidiosa* and *R. subfragiliformis* Murr., FLAS. — Sugarfoot Hammock, Singer F 2553 and F 2554, FH. — Highlands Co., Highlands Hammock State Park, Singer F 171, FH.

The types of *R. cystidiosa* and *R. subfragiliformis* are so similar they might have come from the same mycelium (which they did not). Although the color of the stipe is indicated as white in the former, there is one specimen in the type collection that has partly pink stipe. There are also "authentic" collections of *R. subfragiliformis* which do not belong here (FLAS), e. gr. one with darker spore print, one without dermatopseudocystidia, the latter belonging to the *R. xerampelina* complex. *R. cystidiosa* is a very pretty species of the *Pusillinae* and differs from *R. pusilla* in still brighter colors, frequently pink stipe and more consistently non-reticulate spores, also in the slightly deeper average spore print color and more prominent cystidia.

Russula lividirosea Murr., Bull. Torr. Bot. Cl. **67**: 278. 1940.

Pileus between "Corinthian red" and "deep vinaceous", the center with some "acajou red" (R.), velutinous, glabrescent in age, even, often sulcate on the rounded-obtuse margin in age, convex to applanate, often with depressed center, 40—50 mm. broad. — Lamellae white, then cream color, anastomosing, simple or many forked at the stipe, rather close, equal, subventricose, attenuate toward the stipe and sbufree to slightly subdecurrent; spore print C when fresh but intensitiy about D in herbarium specimens with the tone quality between C and E (i. e. yellower than C) (Crawshay). — Stipe white at the base, pink above or entirely pink all over, glabrous or subglabrous, smooth or subrugulose, spongy-solid, subequal or tapering upward, 30—40 ⇌ 8—14 mm. — Context white, unchanging; taste mild; odor none.

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Spores 8.2—10.5 ⇌ 7.5—9.3 μ, orn. 0.3—1.3 μ, of type VI, fewer either IV or V, occasionally some with short ridges (IV—II) but a majority with extremely fine connecting lines (some so indistinct in oil immersion the may pass as negligible but would make the orn. III b, even III a); basidia 40 ⇌ 11.2 μ, clavate, 4-spored; cystidia distinctly with banded contents in the middle, ventricose in the middle, often ampullaceous, e. gr. 68 ⇌ 9.5 μ; epicutis of pileus consisting of hyphae and moderately numerous dermatopseudocystidia, the latter neither multiseptate or very narrow, with finely granular to coarsely banded contents, usually clavate and moderately broad, reaching 10.5 μ in diameter; hypodermium consisting of a cutis made up by filamentous hyphae, rather dense and with vividly alizarin pink dissolved intracellular pigment which disappears soon in ammonia mounts.

$FeSO_4$ very slowly pale grayish reddish, very weak reaction. — Phenol chocolate. — SV on dried stipe carmin, soon fading to brownish. — KOH on surface of pileus reddish brown, on margin more red.

On the ground under *Quercus,* preferably in low hammocks, rather rare, fruiting in summer and winter. Florida.

Material studied: Alachua Co., type of ***R. lividirosea*** Murr., FLAS. — Highlands Co., Highlands Hammock State Park, Singer F 255, FH.

When fresh, this looks like a thin and small ***R. lepida*** with a vinaceous cast on the pileus, but when dried it reminds one of ***R. alachuana*** (as also implicitely state by Murrill). The two collections, differing in the time of fruiting, are otherwise very similar and were compared carefully. Murrill's specimen is more advanced in age and slightly larger. ***R. lividirosea*** is obviously very close to ***R. pusilla*** but differs in the color of the pileus. It is possible that the very young and fresh lamellae have a slightly acrid taste, but this was not the case in the author's specimen, nor apparently in Murrill's type.

Section *Fragiles* Fr.

Subsection *Puellarinae* Sing.

Russula appalachiensis Sing., Sydowia **2**: 39. 1948.

Pileus on margin 4 J 9, 1 A 9, "doge", "dianthus" (reddish to purplish), on disc with livid or greenish spots, or mostly much deeper brownish purple, e. gr. "garnet br." or "maroon", intermediate zone pl. 3 C 1, between "garnet br." and "clover pink" (M&P), in many caps the three zones not well differentiated and sometimes uniformly dull purple with deeper center, on the margin sometimes with "pepper red" areas, usually deep purple all over when young, some-

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times with brownish ochraceous areas, usually pallescent in marginal zone in age, and there tending to become "honey sweet" or "buff", or with "honey sweet" to "buff" (M&P) blotches, glabrous, naked, slightly rugulose to smooth, but with eventually occasionally very finely rugulose-rimulose margin which is smooth, then short-sulcate, obtuse then rounded, viscid, with the pellicle separable part way to the disc, hemispheric, soon convex, eventually applanate, or flat-convex with shallowly depressed center, or with rather deeply depressed center, 18—75 mm. broad, mostly 30—60 mm. — Lamellae cream colored, almost narrow to rather broad (3.5—4.5 mm.), broadest in frontal third, close or subclose, anastomosing, simple to slightly intermixed with forked ones, equal or slightly intermixed with lamellulae, usually with few lamellulae, adnexed or attenuate-subfree; spore print C or B—C (Crawshay), invariably and exactly so. — Stipe white, usually becoming yellowish brown from the base upward, or with yellow-brown small spots, rarely found with no traces of yellowing, most frequently with yellow-brown base and white apex, when old, in rainy weather watery white with stramineous, glassy base, or entirely stramineous to yellow-brown, subrugulose, versiform, usually in the middle constricted, or ventricose in lower half, or tapering upward, or equal, solid, then stuffed-hollow, or stuffed, 2—70 ⇌ 4—15 mm. — Context white, in old specimens somewhat ochraceous, especially in the base of the stipe, fragile; taste mild, but after a few seconds slightly acrid in young and fresh pilei especially in the lamellae, rarely not at all acrid; odor none.

Spores 8.2—10.5 ⇌ (6.8) 7—8.3 μ, orn. 0.4—1.1 μ, of type III a, III b, IV, mostly III a—III b, with extremely fine connecting lines; basidia 27—34 ⇌ 8.3—11.7 μ, 4-spored, rarely a few 3-spored ones in some caps, macrocystidia on edge and on sides of lamellae scattered to rather numerous, more scattered in mature material, more numerous near the edge in many specimens, with banded contents, in their larger part bluing in SV, cylindrical to subclavate or fusoid, sometimes capitate, with or more often without appendage, at the tip acute or rounded, 55—65 ⇌ 7.5—11.5 μ; cheilocystidia very few in most specimens, inconspicuous and small, versiform, scattered; hymenophoral trama cellular-vesiculose (with comparatively few filamentous connective hyphae); subhymenium consisting of small isodiametrical elements; hymenopodium well developed, hyphous; epicutis of pileus with rather numerous dermatopseudocystidia, bluing in SV; all hyphae without clamp connections.

$FeSO_4$ pale sordid gray to vinaceous gray (normal reaction) in context of stipe. — Phenol in context brown, eventually chocolate, or directly chocolate. — A mixture of phenol and formalin on context: purple. — Formalin on context melleous pallid, almost negative.

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— KOH on surface of pileus ocher yellow, on base of stipe accentuating the yellow. — NH_4OH on surface of pileus and on context negative.

In mixed woods (*Populus-Fagus-Betula*) or in oak woods on the ground, also in swampy woods near *Populus* and *Betula* with intermixed conifers, solitary, more rarely gregarious, rather common in northern and mountain woods, from Massachusetts south to North Carolina, and west to Michigan, fruiting from June until September.

Material studied: *Mass.*: Mount Wachusetts, Singer (not preserved). — *Md.* Tacoma Park, August 15, 1919, C. H. Kauffman, MICH. — *Va.*: Mountain Lake, Singer V 169, FH, type. — Ibid. Singer F 288, FH, syntype. — *Mich.*: Rock River, C. H. Kauffman, (as *R. operta*), probably this, MICH, LE. — Tahquamenon Falls State Park, Luce Co., Singer N 237, MICH, F. — Douglas Lake, Cheboygan Co., Singer N 331, N 615, MICH, F. — Pellston Hills, Emmet Co., Singer N 587, MICH, F.

This is very close to the European *R. puellaris* Fr. which according to many years of experience hardly ever occurs with the slightest acrid taste in young specimens. It is also different from *R. puellaris* in having more reticulate spore ornamentation, and different habitat (although some of the accompanying trees may also be found with *R. puellaris*). The taste makes one think of *R. blackfordiae* which, however, differs constantly in deeper colored spore print. Nevertheless, in the field, it is often difficult to differentiate between the two species without taking a spore print. This recalls *R. caucasica*, but this Asiatic species has larger spores with denser ornamentation and different pileus characters, apparently also different habitat. In the United States, this species has been collected frequently, but was misdetermined *R. puellaris*. For example, the *R. puellaris* of Peck' and most certainly that of Beardslee (in Coker) is *R. appalachiensis*. The latter differs from *R. sphagnophila* var. *subingrata* (see under *R. sphagnophila*) in more reticulate spores and a stronger tendency to stain yellow.

Subsection *Emeticinae* Melzer & Zvára.

Russula emetica ssp. lacustris Sing., Revue de Mycologie **15**: 133. 1950.

Syn.: *Russula perlactea* Murr., Lloydia **6**: 213. 1943.
?*Russula emeticiformis* Murr., Mycologia **30**: 362. 1938.
?*Russula subacris* Murr., Bull. Torr. Bot. Cl. **67**: 279. 1940.
?*Russula pervirginia* Murr., Lloydia **8**: 268. 1945 (1946).

Pileus about "jasper red" (R.), also sometimes tending toward "nopal red" "Brazil red", or "scarlet red" in some collections, the center occasionally reaching "pompeian red", some caps partly pink

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"coral pink", "begonia rose", (R.), eventually with large white areas all over the pileus and more "light jasper red" (R.) on the margin, or bleaching in the marginal zone also and sometimes entirely white in age ("*R. perlactea*"), especially after heavy rains, rarely bleached in an early stage, subviscid to moderately strongly viscid, opaque to subopaque when dry, with entirely separable cuticle, glabrous, smooth, with smooth, subobtuse to obtuse margin which becomes obtuse to somewhat rounded and either remains smooth or becomes short to long tuberculate-sulcate, convex and usually umbilicate, then convex depressed center, then applanate with deeply depressed center and sometimes becoming concave, (20) 30—52 (62) mm. broad. — Lamellae white, eventually pallid, not cream color, or becoming brownish or yellowish on the edges when beginning to dry out, moderately broad (4—8 mm.), with entire edge (not fimbriate), broadest in the frontal third, subclose to (mostly) moderately close or subdistant, equal or with some lamellulae of about half-length, some forked ones present in some carpophores, more or less anastomosing, not ventricose or very slightly so, attenuate-subfree, sinuate or rounded-adnexed, narrowly or broadly adnexed, also, in age, subattingent subdecurrent on enlarged apex of stipe; spore print white, A, or almost A, never near B (Crawshay). — Stipe white, eventually assuming a tinge of "pale pinkish cinnamon" (R.) or somewhat yellowish, or else just watery subhyaline to glassy-sordid when wet, smooth to rugulose, glabrous, solid or stuffed, subequal or tapering downward, 20—42 ⇌ 11—19 mm. — Context white, unchanging; submild to subacrid or more usually after a shorter or longer period of mastication distinctly, often strongly, acrid; odor when quite fresh none at all or somewhat like that of ssp. *fragilis*, when old and drying somewhat like that of ssp. *mairei*, i. e. of honey.

Spores 9—14 ⇌ 7—12 µ, orn. 0.8—1.6 µ, mostly 1—1.3 µ, of type III a, the connecting lines very fine to rather thick and rarely crossing each other without merging into one of the spines; basidia 35—50 ⇌ 12—15 µ, 4-spored; sterigmata 7—17 µ long; macrocystidia not blue in cresyl blue mounts, with abundant blue bands in SV, rarely merely granularly stuffed, 82—92 ⇌ 11—12 µ, mostly ventricose in the upper third or quarter, or else ventricose-fusoid to ventricose-subcapitate, many appendiculate or mucronate, often exuding amorphous masses at the apex, hyaline, some sometimes yellowish, numerous and within 1 mm. from the edge exceedingly numerous; subhymenium consisting of small isodiametric or subisodiametric cells (8—14 µ in diameter), underneath it a filamentous hymenopodium; hymenophoral trama predominantly vesiculose but with a fairly large number of filamentous hyphae intermixed; epicutis of pileus consisting of hyphae and very numerous dermatopseudocysti-

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dia bluing in SV, all imbedded in a gelatinous mass; hyphae of hypodermium forming a cutis, denser than in epicutis; all hyphae without clamp connections.

Anilin on lamellae pale brownish to pale citrinous or citrin color, only in young specimens vaguely grayish within an hour, weakly gray in two hours, not distinctly glaucous or slate gray around the reacting zone. — NH_4OH on context: on reaction.

On the ground and more rarely on decayed wood in low places, often in the inundated areas around ponds, lakes, or creeks, often near (never on) *Sphagnum,* near conifers (*Pinus,* etc.) and frondose trees (e. gr. *Quercus*), in Florida in stands of *Pinus palustris, Quercus nigra, Liquidambar styraciflua, Taxodium distichum, Nyssa silvatica, Acer rubrum;* in the north under *Tsuga canadensis, Picea mariana, Betula lutea, Populus tremuloides,* etc., in Florida fruiting in winter (November until April), in the north in summer (July until August). Known from Florida and Michigan, probably widely distributed and mistaken for *R. emetica* ssp. *emetica.*

Material studied: *Fla.*: Alachua Co., Newnans Lake, near Dayville, swamp three miles SW of Gainesville, Sugarfoot Hammock, etc., Singer, F 1662, type, F 1784, F 1784 a, F 1691, F 1662 a, FH. — Columbia Co., Camp O'Leno, W. A. Murrill and Alachua Co., Sugarfoot Hammock, W. A. Murrill, F 19101, F 17484, FLAS. — *Mich.,* Emmet Co., Colonial Point, Burt Lake, Singer N 926, MICH, F. — Cheboygan Co., Carp River, Singer N 616, MICH, F.

This is a common *Russula* in the Florida winter season, and relatively rare in the north. It differs from *R. emetica* ssp. *emetica* in lacking the conspicuous gray to glaucous ring around the drop of aniline on the lamellae; it is slightly smaller, and does not grow in *Sphagnum.* It differs from all other subspecies of *R. emetica* in the higher spore ornamentation. The red forms are correctly determined (by Murrill) in the Herbarium of the Agricultural Experiment Station, University of Florida, Gainesville, Fla., but bleached forms have apparently been described as separate species, especially *R. perlactea* which is obviously the same species while the other two species cited as synonyms are most probably, but not absolutely certainly, identical. In *R. pervirginea,* type, the spores are slightly smaller, and approach the characters of *R. pantoleuca* Sing. *R. emeticiformis* agrees well except for the fact that the color of the pileus is slightly different.

Russula emetica ssp. **emeticella** (Sing.) Sing. stat. nov.

Syn.: *Russula emetica* ssp. *fragilis* f. *emeticella* Sing. Beih. Botan. Centralbl. **49** II: 307. 1932.
Russula fragiloides Murr., Lloydia **8**: 265. 1945 (1946).

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Pileus rose red, flesh red, "Nopal red", "coral red", "jasper red" (R.), viscid, glabrous, smooth, later tuberculate-sulcate on the margin, with obtuse margin, convex and often umbilicate, later applanate and with depressed center, 25—60 mm. broad, mostly about 30—45 mm. — Lamellae white, unchanging, mostly simple, equal or with very few lamellulae inserted, rather narrow to fairly broad (2—6 mm., mostly 4—5 mm. broad), subclose to crowded, with entire edge (not fimbriate), adnexed to free; spore print white (A, or almost so, never reaching B, Crawshay, in fresh prints, but after a year in the herbarium usually pale cream). — Stipe white, glabrous, subequal or tapering upward, subrugulose, stuffed, eventually spongy-hollow or hollow, 32—42 ⇌5—11 mm. — Context white, unchanging, thin and fragile; taste almost at once decidedly acrid; odor none or slight and fruity.

Spores 8.2—9.2 ⇌ 6.8—7.5 μ, orn. 0.5—0.9 μ, not higher, of type III a, with occasionally a few short ridges (IV—II), the connecting lines crossing each other without a wart at the crossing point in at least a large number of spores; basidia slightly smaller than in ssp. *lacustris;* all other microscopical characters as in the latter.

$FeSO_4$ on context of stipe salmon to grayish salmon. — Phenol on context chocolate. — Aniline on lamellae orangy with a gray margin after a short while. — KOH on pileus yellowish. — Alpha-naphthol on flesh: slow reaction, not bluing within the first 5 minutes of exposure, then blue.

On the ground and on moss pads in frondose woods and hammock under oak and beach (e. gr. *Quercus virginiana, Fagus grandifolia*), from Canada south to Florida and west to Michigan, possibly to the Pacific Coast; Europe, Asia.

Material studied: Numerous collections from Asia and Europe (Germany, Austria, France, Spain) and North America, including Florida (not seen in South Florida). No type was designated in the original description. It is now proposed that H. Romagnesi, Oct. 3, 1944 from St. Germain-en-Laye (S.&O.), France, FH, be designated as lecto-type. This specimen was sent to the Farlow Herbarium in 1945 as *Russula emetica* f. *silvestris* Sing. which gives a good key to the understanding of Romagnesi's interpretation of this forma. However, the forma as described originally by the present author, is characterized by the spore type of ssp. *emetica,* i. e. spores large with high spines and the connecting lines never crossed. It differs from ssp. *emetica* merely in the somewhat smaller size and the occurrence outside the Sphagneta [whereas typical ssp. *emetica* (f. *gregaria*) is sphagnicolous, large and gregarious]. It was collected by H. Romagnesi among *Leucobryum glaucum* under *Castanea vesca* at Yerres, France, September 26, 1938 and is also deposited

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at the Farlow Herbarium. The same form was also collected by Vasilieva in the Caucasian National Park, Western Caucasus, near Guzeripl. It is, however, rather rare in Europe and Asia, as far as known, and has not been collected in North America (unless = ssp. *lacustris*).

The description of *R. emetica* ssp. *emeticella* given above, is entirely based on American material. However, the characters coincide perfectly with those of the European specimens. Our material refers to f. *fagetorum* Sing. (as subforma) which we believe necessary to separate from the form occurring with conifers (f. *pinetorum* Sing., as subforma). The latter is also common in the United States as well as in Asia, and Europe. A typical example of the f. *pinetorum* is a collection from Kivacz, Karelia, Sept. 1936, S i n g e r & F r e i n d l i n g, LE. We have several collections from Michigan, U.S.A. *Russula emetica* ssp. *emetica* sometimes occurs together with *R. emetica* ssp. *emeticella* in *Sphagnum* bogs, but differs strongly by having a higher spore ornamentation. The aniline reaction in typical ssp. *emetica* is very definitely glaucous after a short while, the glaucous, slate gray to sea green discoloration pervading the entire lamellae as it is carried over by the vapors of the aniline oil. The occurrence of typical Sphagnetum-*emetica* in North America had already been established by Kauffman who called what is unmistakably ssp. *emetica* — forma *gregaria* Kauffmann, and the type was studied and coincided with the microscopical data known of ssp. *emetica*. In addition, the author succeeded in collecting fresh material in the same state, Michigan, e. gr. S i n g e r N 998 and N 795 MICH, F, from Tahquamenon Falls State Park, Luce Co. in the summer of 1953. The somewhat thinner, more elongate f. *longipes* has not been found with certainty in the Western Hemisphere. *R. rugulosa* and *R. crenulata* seem to be consubspecific with ssp. *emetica* (although, since the occurrence of ssp. *lacustris* in the north has been established, and the aniline reaction remaining unknown for the type specimens of *R. rugulosa* and *R. crenulata*, no definite proof can be given that they are *not* ssp. *lacustris*).

R u s s u l a e m e t i c a ssp. *a q u o s a* (Leclair) Sing., Revue de Mycologie **1**: 292. 1936.

Syn.: *Russula aquosa* Leclair, Bull. Soc. Mycol. Fr. **48**: 303. 1932.
Russula fragilis var. *carminea* J. Schaeffer, Ann. Mycol. **31**: 461. 1933.

Pileus colored as ssp. *emeticella* on the margin, or purple on the margin with all intermediates, the center usually livid brown to blackish purple or reddish black, often found carmin with much deeper center, e. gr. "Afghan red" to "red banana" (M&P) on the

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margin, with smooth, eventually sulcate margin, with obtuse eventually rounded margin, viscid, glabrous, with the pellicle separable except over the deep colored part of the center, convex, most frequently soon depressed in the middle, or becoming applanate on the margin, eventually sometimes concave, 25—60 mm. broad. — Lamellae white, eventually pallid, not cream, with entire edge (not fimbriate), close, more rarely subclose to subdistant, attenuate-subfree to adnexed or sinuate, medium broad, or narrow, spore print white (A, sometimes approaching but never reaching B, Crawshay). — Stipe white, the base sometimes becoming yellowish when wet, usually as long or longer than the pileus diameter, solid, then stuffed to stuffed- hollow, versiform, 25—70 ⇌ 5—13 mm. — Context white, unchanging, fragile, especially in the stipe, tending to become watery-glassy in we weather or pale yellowish in base; taste mild, rarely remaining mild, but slowly although, for an *emetica*-form rather weakly, acrid after some mastication, hardly ever strongly and intensely burning the tongue; odor none to weakly fruity, not of coconut-candies.

Spores 7—11.8 ⇌ 5.8—9 μ, orn. 0.5—1.1 μ, mostly 0.5—0.7 μ, of type III a or III b, more rarely III a—VIII or III b—VIII, with the spines variably dense more often rather dense, the fine connecting lines often crossing each other between the spines; basidia 35—36 ⇌ 12.3—12.5 μ, 4-spored; macrocystidia rather numerous to very numerous, with dense bluing banded contents (SV), versiform, mostly ventricose, often long-appendiculate (4—4.5 μ in most cases), 38—60 ⇌ 7—11 μ; epicutis of pileus consisting of filamentous hyphae and dermatopseudocystidia of the macrocystidial type, the latter rather numerous to very numerous (often much less numerous than in other subspecies of *R. emetica*), rounded above, sometimes with comparatively little banded contents, sometimes wiht abundant banded contents, blue in SV, 34—130 ⇌ 5—11 μ, mostly 50—60 ⇌ 7.5—9.5 μ; spherocysts of the context about 30—35 ⇌ 20—25 μ; hyphae without clamp connections. Numerous dermatopseudocystidia on the surface of the stipe.

$FeSO_4$ on context of stipe normal reaction, i. e. less salmon than usually in ssp. *fragilis*. — Aniline on lamellae varying from very little reaction (greenish-citron to brownish red) to yellow and around the yellow spot after hours reaching no more than a slight grayish margin (pl. 39 E 2, M&P); on stipe becoming yellow from the vapors around a salmon colored dot, not gray. — SV on dried stipe blackish-violet-fuscous. — Alpha-naphtol very slowly and slightly blue.

In low coniferous woods and in mixed woods near conifers in swamps, e. gr. under *Picea mariana, Larix, Tsuga* etc., on the ground, not rare in North America, fruiting in summer and fall. Also in Europe.

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Material studied: Europe: Leningrad region, Singer 8—131, LE. — Lakhty, Leningrad Region, 8—139, LE. — Kivacz, Karelia, Singer, 9, LE. — U.S.A.: *N.Y.*: Newcomb County, Huntington Forest, Singer 19, FH. — *Mich.*: C. F. Kauffman, LE. — Tahquamenon Falls State Park, Chippewa Co., Singer N 516, MICH, LE.

The subspecies described above is characteristic for the coniferous woods of the northern states and northern Europe, but occurs, less frequently, also in other parts of Europe and the United States. The less acrid taste alone is not enough of a character to separate this from *R. emetica* ssp. *fragilis* inasmuch as the form called *R. fallax* by Kauffman, and quite frequently encountered in Northern Michigan, differs from this in a distinctly positive aniline reaction, i. e. the gray ring around the yellow center (on the lamellae reacting with aniline oil) is very distinct here, yet the taste is far less acrid than in typical ssp. *fragilis*. This form has the colors of f. *griseo-violascens* or f. *fallax* and occurs in low woods, and swamps among mosses. In northern Europe, *R. emetica* ssp. *aquosa* is characteristic for the *Picetum oxalidosum*, especially in low places, on the ground, but is occasionally also found in low woods of *Pinus silvestris* and *Betula pubescens*. *R. emetica* ssp. *aquosa* is not a typical sphagnicolous species.

Russula emetica ssp. *fragilis* (Pers. ex Fr.) Sing. is hardly in need of redescription. It differs from ssp. *aquosa* in the aniline reaction, constantly strongly acrid taste, frequent presence of a coconut candy odor (but this is not constant in the whole range of the forms included by the author in ssp. *fragilis*), and by frequently crenulate-fimbriate lamellae-edges. This is now restricted to forms with purple to violet, lilac, and grayish-vinaceous pileus, with frequently deep violet to blackish brown or greenish center also occasional white forms included, excluding however the bright rose to flesh red or bright red forms now redescribed as ssp. *emeticella*. If a separation of those color forms had to be proposed, those transitory forms occasionally found, with bright red marginal zone and deep violet center, should be placed in ssp. *fragilis*. This is in keeping with Fries's original concept of *Agaricus fragilis* Pers. In North America, ssp. *fragilis* was renamed *Russula fragiliformis* Burl. Mycologia **8**: 312, 1916. This subspecies, as redefined here, is common in North America. Innumerable collections have been made in various northern States and in the mountain ranges of Eastern North America. Recent material has been gathered in northern Michigan, for example Carp Creek, Cheboygan Co., Singer, N 730, MICH, CF, and Tahquamenon Falls, Luce and Chippewa Co., Singer, N 872, MICH, F.

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Russula pantoleuca Sing. spec. nov.

Pileo albo vel sordido, levi, viscido, glabro, 43—59 mm. lato. — Lamellis albis, latis, confertis; sporis in cumulo albis. — Stipite albo, 25—30 ⇌ 11—15 mm. — Carne alba, immutabili; sapore in lamellis junioribus subacri subamaroque; odore debili. — Sporis 8.3—11 ⇌ 6.5—8.3 μ, ornaméntatione 0.4—0.8 μ alta, reticulata vel subreticulata praeditis; macrocystidiis 42—56 ⇌ (8)9.5—10 μ; epicute pilei dermatopseudocystidiata. — In silvis humidiusculis ad terram, Woburn, Mass. typus.

Pileus white or whitish in a marginal zone, pale sordid ("Dorado", "grain" M & P) in a central zone, or whitish in the center as well as on the margin, but here and there with an umber-cream to pale greenish tinge, never more distinctly pigmented, but with small ocher brownish to ferrugineous dots as in *R. maculata* on many caps, smooth, including the marginal zone, with obtuse margin, viscid, glabrous, with readily peeling cuticle all over the pileus surface, convex, then applanate or subdepressed in the center, 43—59 mm. broad. — Lamellae white, sometimes with partly ferrugineous or ocher brownish spotted edges, with few lamellulae, or with numerous irregularly intermixed ones, with or without numerous forked ones, broad (5.5—7 mm.), close, more or less anastomosing, at the margin at first slightly incurved, then obtuse but not rounded, or eventually rounded, rather thickish, or normally thin, adnexed; spore print white (A, or between A and B, but in fresh condition never reaching B, Crawshay). — Stipe white, smooth, then rugulose, solid, then hollow equal or toward the base attenuate, 25—30 ⇌ 11—15 mm. — Context white, unchanging, not thin, but fragile; taste mild, only in the young fresh lamellae slightly acrid and at the same time slightly bitterish; odor weak, of apple.

Spores 8.3—11 ⇌ 6.5—8.3 μ, orn. 0.4—0.8 μ, of type III b, fewer of type III a, some III b—II, III b—VIII, IV—II, VIII, IV; basidia 41—45 ⇌ (7)—9—10.5 μ, 4-spored; macrocystidia (in SV blue) with banded contents, but the latter not very dense and in some individual cells wanting, sometimes appendiculate, sometimes toward the apex somewhat thick-walled, fusoid, moderately numerous, 42—56 ⇌ (8) —9.5—10 μ; cheilocystidia very crowded, hyaline, without contents, sometimes with slightly thickened wall toward the apex, the latter often with a button, or crown-like excrescency, versiform, mostly cylindrical or clavate, fusoid or subulate, 38—42 ⇌ 7.5 μ; epicutis of pileus consisting of hyphae and dermatopseudocystidia of the macrocystidia-type (blue in SV), with variable contents, fusoid, 3.5—5.5 μ broad; surface of stipe also with dermatopseudocystidia.

$FeSO_4$ on context of stipe almost negative, weakly grayish reddish to grayish-sordid in the wet vitreous portion of the stipe. —

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Phenol on context chocolate. — Formalin on context of stipe extremely slightly and slowly pinkish pallid, almost negative.

Under *Quercus, Betula* and *Fagus,* in somewhat humid mountain woods and in somewhat swampy places where few pines are intermixed, gregarious but rare, fruiting in September, New England.

Material studied: *Mass.*: Mount Wachusetts, about 1800 ft alt., September 20, 1947, Singer, FH, paratype. — Woburn, September 18, 1943, Singer, FH, holotype.

In both *R. albidula* Peck sensu Kauffman and *R. pervirginea* Murr., the spores are more often completely reticulate (III a) than partly (III b) and in the former with higher spinules. *R. albidula* in the sense of Beardslee has light ochraceous spore print. The type of *R. albidula* Peck seems to have been lost at Albany. *R. albella* Peck belongs obviously in another group. *R. anomala* Peck (*subalbidula* Murr.) has been redescribed and distributed by the author (Reliquiae Farlowianae), and is quite different. *R. crenulata* is a species with higher ornamentation as far as can be judged by the material studied by the author. It has more strongly acrid taste, and does not belong here. Since *R. pantoleuca* seems to be rather rare, it is not unexpected to find it undescribed.

The commonest species in this subsection in North America is, aside from the *emetica*-complex itself, *R. vinacea* while *R. atropurpurea* Krombholz does not occur (it has, by the way, never been found in Eastern Europe either). *R. atropurpurina* (Sing.) Crawshay, in the original sense, is now considered as *R. vinacea* which may be adventive in Europe. It was found only once. Colors, habit and spores are exactly as in the North American species. The latter has been redescribed by the author in his recent Type Studies.

Subsection *Sardoninae* Sing.

Russula gracilis Burl., North Amer. Flora **9**: 222. 1915.

Syn.: *Russula gracillima* J. Schäffer, Zeitschr. f. Pilzk. **10**: 105, 1931.

A redescription of this species is not necessary since it has been described in detail both by Singer (4, 1932) and J. Schäffer (7, 1933, as *R. gracillima*). J. Schäffer also published a colored picture, and distributed exsiccata. The American specimens are identical with the European ones in every particular:

Material studied: Sweden, Fynningo, coll. Ingel & Critin, Oct. 1, 1950, S. — USSR., Moscow region, Kratovo, Sep. 1940, Singer, LE. — Germany, Potsdam, type of *R. gracillima,* and topotypical material, Singer. — USA.: *Vt.,* type of *R. gracilis,* NY. — *Mich.*: Nine Mile Point, Presque Isle Co., Singer, N 1296, MICH, F. — Wilderness State Park, Emmet Co., Singer, N 696, MICH, F.

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Russula robinsoniae Burl., North Amer. Flora **9**: 221. 1915.

Pileus purplish red to "dull Indian purple", "livid brown", or "brownish vinaceous" (R.), sometimes exactly like "rosedale" or almost "pomegrenate" (M & P), in the center concolorous or with some fuligineous, chamois, or greenish tinge, or occasionally pallid, color much as in *R. queletii,* glabrous, viscid, with smooth, subobtuse to subacute margin, later tuberculate-sulcate on the margin, smooth in the portion between center and margin, with the pellicle separable at least over the marginal third, convex then applanate to uplifted at the margin, eventually with broadly rounded margin, with obtuse to subumbonate center, 30—70 (150) mm. broad. — Lamellae white, soon becoming light ochraceous cream, not staining lemon or citrine or greenish on injury, rather frequently some forked ones present, always with a few lamellulae, tending to turn brownish after a long times where bruised, rather narrow (about 4 mm. broad), close to subdistant, more often close, narrowed to the stipe, but adnate to subdecurrent; spore print E (Crawshay). — Stipe white or usually rose colored ("doge" to "ember" M & P), sometimes staining reddish ochraceous at the base, but stain later bleaching, pruinose as *R. queletii,* glabrescent, rugulose, versiform, often gradually thickened or even subbulbous at the base, solid, then spongy-stuffed, 30—100 ⇌ 10—25 mm. — Context white, thin, moderately fragile, unchanging; taste moderately acrid (but rapidly so) and at the same time bitter; odor exactly as *R. queletii* or *R. fellea* (compote of pears).

Spores 9.2—10.3 ⇌ 7.2—8.3 μ, orn. 0.3—0.7(0.9) μ, of type IV, rarely V or VI, very rarely III b, but often with short ridges (IV—II) which may form ridges prolonged into chains (IV—II—VIII), with warts which, if not laterally elongated, are still rather coarse and often connected by barely visible extremely fine lines (III a—III b); basidia 25—32 ⇌ 6.5—11.5 μ, 4-spored; macrocystidia abundant, with banded contents, bluing in SV, 58—68 ⇌ 5.8—14.5 μ, often appendiculate, clavate or fusoid, acute or rounded; epicutis of pileus with numerous dermatopseudocystidia with banded contents and blue in SV.

NH_4OH on context negative.

On the ground in moist coniferous woods (*Picea, Abies, Thuja, Tsuga* often with some *Alnus* present), fruiting in summer and fall, Northwestern United States and east to North Michigan.

Material studied: *Mich.*: Nine Mile Point, Presque Isle Co., Singer, N 1269, MICH, F. — Tahquamenon Falls State Park, Luce Co., Singer, N 981, MICH, F. — *Wyoming,* type, NY. — *Ore.*: Waupinita summit, Cascades, A. H. Smith, 19081, FH, MICH.

In the field, this species is so similar to *R. queletii* that any European mycologist would immediately take it for that species;

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however, the spore print is considerably deeper colored, the discoloration of the lamellae is never citrine to greenish, the reaction of the context with ammonia is a different one and the taste has a bitter component. The two species are, although closely related, by no means identical. It was originally inserted in this subsection by the present author, but believed to be closer to the other species with deeper colored spores, such as *R. americana, R. pulchella,* etc., but after fresh material was examined, it became obvious that the species belongs in the neighborhood of *R. queletii. R. robinsoniae* seems to have the same geographical area as *R. crassotunicata.*

Subsection *Sanguininae* Melzer & Zvára.

Russula pulchella Borszcz., Fungi Ingrici, p. 58. 1857.
Syn.: *Russula palustris* Peck, Ann. Rep. N. Y. State Mus. **53**: 842. 1900.

Pileus reddish: pl. 4 J 9, "bois de rose", "maroon" to "mascara", "meadowsweet" (M & P), duller in age and often tending to bleach over wide areas, generally pinkish purple and pallescent, sometimes with olive (pl. 14 K 2) or brown center, very rarely (f. *decolorata* Sing.) entirely olive greenish, viscid, glabrous, opaque when dry, with acute, then obtuse, smooth, often sinuate, then broadly sulcate, more rarely short-sulcate to smooth margin, otherwise smooth or more rarely rugulose-subscrobiculate, with partly separable cuticle (over one half to two thirds of the radius), convex, then with depressed or flattened center, subumbonate or obtuse, eventually irregularly depressed or applanate, characteristically asymmetrical in many (especially early) collections, 35—63 mm. broad. — Lamellae whitish, then pale ochraceous, close to subdistant, attenuate-free, anastomosing, equal, simple or forked, moderately broad (5 mm.), spore print E, in earlier collections often with the tone quality of E but somewhat paler (as deep as D), Crawshay. — Stipe entirely white or much more commonly partly to almost entirely pink (pink: pl. I H 2, or lighter M & P), versiform, often equal, at first solid, 32—60 ⇌ 10—20 mm. — Context white, unchanging, but sometimes with a tendency to become slightly grayish hyaline to grayish white, not tending to stain yellow; taste acrid to subacrid, mostly distinctly but not intolerably burning, in age tending to be submild; odor none or very slightly fruity (not as in *R. queletii*).

Spores 8—10 ⇌ 5.8—8 μ; orn. 0.4—0.9 μ, of type III b, IV, few III a (with a distant network of very fine lines), V, VI—VIII; basidia 36 ⇌ 10—11.5 μ, 4-spored; macrocystidia 38 ⇌ 8.5—9 μ or longer, versiform, blue in SV; epicutis of pileus hyphous with numerous dermato-

*) Incl. material from the type locality of *R. pulchella* Borszcz, LE.

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pseudocystidia which turn blue in SV; dermatopseudocystidia also very numerous on surface of stipe.

Formalin on context of stipe negative.

On the ground, often on sandy soil, in mixed frondose woods, especially under *Betula* and *Quercus,* usually in small groups, fruiting from June until September, New York to Michigan (probably with a wider area in North America), also in Europe and Northern Asia.

Material studied: Numerous collections in Europe (Austria, Germany, Sweden, France, Spain, U.S.S.R.*) and Asia (Altai Mts.), U.S.A.: *N. Y.,* type of *R. palustris* Peck, NYS. — Newcomb Co., Huntington Forest, Singer, HF 203, FH. — *Mich.* Mackinaw City Hardwoods and Wilderness State Park, Singer, N 438, N 1072, N 1073, MICH, F. — Cheboygan Co., Douglas Lake, Singer, N 304, MICH, F.

This species has been called ***R. exalbicans*** (Secr.) by Melzer & Zvára and this nomenclature has been followed by some authors in Europe until J. Schaeffer decided, without having good reason to do so, in favor of *R. depallens* (Pers. ex Fr.) Fr., or rather "*depallens* Fr." Since there is no chance to prove any more about *R. exalbicans* than about *R. depallens,* it is best to abandon both these "classical" names, and go back on safe ground by adopting a specific epithet that has also had its place in the classical works and can be shown to be this on the basis of topotypical material.

R. pulchella is not rare in New York and Michigan. The area of the species in North America has not yet been established. It is probably circumpolar.

Russula rosacea (Pers. ex Secr.) S. F. Gray, Nat. Arr. **1**: 618, 1821, em. Fries, Epicrisis p. 351, 1838.

Syn.: *Agaricus rosaceus* Pers. ex Secr., Mycogr. Suisse **1**: 502. 1833.

Russula sanguinea (Bull. ex Pollini) Fr., Epicr. p. 351, 1838, **non** *Agaricus sanguineus* Wulfen ex Fr.

Russula luteotacta var. *rosacea* Sing. Zeitschr. f. Pilzk. **2**: 16. 1923.

Pileus "jasper red" in the center, often "coral pink" on the margin (R.); "holly berry", "chimney r.", "pepper r.", "lacquer r." or paler (M & P), more rarely paler rose color to bright blood red (not purple carmine), rarely pallid from the beginning, often rather dark in the center, in age with punctate to blotched pigmentation in many cases and often entirely pallescent, slightly viscid and drying out very rapidly, glabrous, opaque, with the cuticle not or scarcely separable in the outer third, with acute, then subacute margin, even-

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tually with subacute margin, smooth, eventually short-sulcate-tuberculate on the margin, convex, then applanate, eventually slightly concave to infundibuliform, sometimes subumbonate or umbonate, or with depressed center, 40—100 mm. — Lamellae pallid then cream ocher, sometimes deep yellow spotted when injured (reaching sulfur to golden yellow or melleous), exceptionally becoming entirely pale ochraceous when old and dried, with few to many forked ones, often with many but irregularly intermixed lamellulae, more or less arcuate especially in young specimens, and remaining so in many older ones, narrow to moderately broad, 4—10 mm., narrowed-adnexed at the stipe and becoming subdecurrent, or distinctly decurrent, close to crowded or moderately close to distant; spore print C to D, occasionally even slightly deeper but not reaching E of F (Crawshay). — Stipe pink (pl. I F 9, M & P) to "watermelon" (M & P), sometimes blotched in these colors, very rarely almost or entirely white, glabrous, subrugulose, versiform, usually ventricose, at first sometimes constricted at the apex, solid, eventually somewhat hollow but not or scarcely spongy, 20—70 ⇌ 9—20 mm. — Context white, pinkish to red under the cuticle and characteristically staining concolorous with the pileus in wounds of the latter, eventually often somewhat yellowish here and there where bruised, also often yellow in wounds of the stipe, rather thick in the pileus, firm, eventually fragile; taste acrid, varying from moderately acrid in the pileus and lamellae to strongly acrid everywhere and at the same time often somewhat bitterish; odor slightly fruity (like a mixture of cooked apples and prunes), but very weak.

Spores 7.5—9.8 ⇌ 6.7—8 μ, orn. 0.4—0.8 μ, reaching 1 μ in some spores, of type IV, more rarely VI, V, III b, in other prints predominantly IV, V, and few IV, III b, or on the contrary most III b (with some rows VIII) and IV, and then even some III a present and only a minority VI and V, i. e. rather variable according to the collection but rather constant in its pattern in a single population; basidia 23—47 ⇌ 9—16 μ, clavate, 4-spored; macrocystidia bluing in SV, 53—88 ⇌ 9—15 μ, subcylindric to fusoid, acute, or ventricose or even subrhomboid, or subclavate and then obtuse to rounded, sometimes many appendiculate (appendage up to 9 μ long), the shorter ones usually rounded at apex, the longer ones appendiculate or acute, yellow or hyaline, deep-rooting; edge of lamellae homomorphous to almost subheteromorphous, but even at the edge some basidia present; subhymenium consisting of small spherocysts forming a thin layer; hymenopodium filamentous-subregular, comparatively thick and well developed; epicutis of pileus little differentiated from the hypodermium (and therefore macroscopically little developed and cuticle difficult to separate), consisting of a cutis of repent to subascendant,

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often short branched and crooked and then non-gelatinized hyphae, and long filamentous, hyaline, smooth, normal hyphae, among them rather numerous and mostly rather narrow dermatopseudocystidia which are acute or obtuse and rounded or appendiculate, bluing in SV, 4—9 μ broad, but some 9—10 μ broad, imbedded in a scanty gelatinous mass, denser in the filamentous cutislike hypodermium which is more pigmented but the pigment not stable in ammonia mounts, hyphae with thin to rather thin walls, without clamp connections; covering layer of stipe much like epicutis of pileus but not at all gelatinized.

NH_4OH on context negative. — KOH on pileus surface yellowish brown. — HNO_3 on pileus surface lighter and brighter. — $FeSO_4$ pale greyish cinnamon. — Phenol chocolate.

On the ground in coniferous woods and in mixed woods under conifers, also in low hammocks and plantations, always connected by mycorrhiza with *Pinus* (*Pinus silvestris* and *P. uncinata* in Europe, *Pinus palustris, P. resinosa, P. banksiana,* etc. in North America, most probably also under other pines), exceptionally also found with other conifers (in Europe only, once under *Picea abies,* once under *Larix decidua*). Europe, Asia, North America, North Africa.

Material studied: Asia (Altai Mts. and Caucasus Mts., Singer, various collections, W, LE); Europe (various collections from Spain — Plá de Murás, Rivera de San Maurici, Aiguamoix, Vall de Neve, San Feliu de Codinas, Singer, BC. — France, Germany, Austria, Sweden, U.S.S.R., Czechoslovakia, etc.). Also from the Philippine Islands (Baguio area, northern Luzon, June 11, 1948, R. S. Davis, det. Singer, FH). North America: Mountain Lake Va., FH, Wilderness State Park, Emmet Co., Mich., Singer, MICH, F, Highlands Hammock State Park, Highlands Co., Fla., Singer FH, etc.

This species is not uncommon in the United States as well as in Europe and Asia; the most remarkable area extension is that to the Philippine Islands, but it is not clear from the collector's notes whether this occurs in native vegetation or in plantations. *F. eurosacea* Sing. characterizes those forms that show adnexed lamellae (rather than decurrent ones); the type is the specimen from Pla de Murás, Catalonia, Spain, see Collectanea Botanica **1** (3): 238. 1948.

The redescription given above is entirely based on American material.

Subsection *Sphagnophilae* Sing.

Russula disparilis Burl., Mycologia **10**: 94. 1918.

Syn.: *Russula echinospora* Sing., Bull. Soc. Mycol. Fr. **55**: 270. 1939.

Pileus "buckthorn brown", or, according to the data on the type,

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"Sanford's brown" or "Hessian brown" in the center, with "warm buff" margin, often "apricot buff" in an intermediate zone (acc. to Burlingham), or else reddish brown all over except for large paler (buffy cream) areas which tend to become greenish in dried material, viscid when wet, opaque when dry, with a faint bloom at times, but mostly glabrous, with the cuticle part way to entirely separable, smooth or slightly tuberculate-sulcate on the margin which is obtuse but usually not broadly rounded, convex, then applanate-depressed, 25—65 mm. broad. — Lamellae white, then "light buff" (R.), close, simple, equal or with very few lamellulae, medium broad to rather broad, broadest in the marginal third, adnexed or rounded-adnexed; spore print not obtained in sufficient quantity but according to scratch samples E, or at least between D and F, ochroleucous according to the original description. — Stipe entirely white or chalk white, stuffed, becoming hollow in age, glabrous, rugulose, equal, up to 65 ⇌ 15 mm., but usually smaller, variable in its relative length (as compared with the diameter of the pileus). — Context white, unchanging, rather firm, eventually spongy-subfragile; taste mild, only in young lamellae very moderately acrid; odor none.

Spores 7.5—11.7 ⇌ 6.8—9.2 μ, orn. 0.4—1.4 μ, mostly about 1 μ, of type V, IV, fewer VI or III b, some with short ridges (IV—II) or rows (VIII—VI); basidia 31—47 ⇌ 9—15 μ; cystidia of the macrocystidia-type, with banded contents, some only with granular contents or "empty", fragile, subcylindric, subfusiform, or fusiform, appendiculate (especially those at the edges of the lamellae), bluing (at least many of them) in SV, reacting over a large part of the interior; edge of lamellae almost subheteromorphous; subhymenium cellular, its elements up to 11 μ in diameter; hymenopodium filamentous, thin, giving rise to the macrocystidia; epicutis of pileus consisting of colorless hyphae, imbedded in a scarce mucilaginous matter and intermixed with moderately numerous oleiferous hyphae with transitions to dermatopseudocystidia which are similar to those observed in *R. integra (velenovskyi)*, septate, bluing in SV but some "empty", some with granular, and some with banded contents, forming transitions to ciliate dermatocystidia which are cylindrical or subulate in their terminal member (20 ⇌ 4.5—6.5 μ), some of the terminal members of the oleiferous hyphae transformed into quite typical dermatopseudocystidia of the macrocystidia-type with rounded apex, clavate or subclavate, 30—50 ⇌ 4—7.5 μ; hypodermium consisting of filamentous hyphae forming a cutis, ocher-greenish, pallid in ammonia.

On the ground in mixed woods under *Juglans, Betula, Pteris, Osmunda,* and *Alnus* near a swamp (Burlingham), under *Larix* and *Betula* (Singer), under *Quercus* and *Acer* (Kauffman), in

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small to large groups, fruiting in July and until October. Massachusetts to Michigan.

Material studied: *Mass.*: Stow, S. Davis, part of type, NY. — Hamilton, Old Harvard Forest, Singer, FH. — *Mich.* Ann Arbor, Kauffman, MICH, LE, type of *R. echinospora* Sing.

The Michigan collection (*R. echinospora*) differs from the Massachusetts collections in being more brown, less green in dried condition, also slightly firmer and with fewer banded cystidia and dermatopseudocystidia, with the habitat allegedly under oak and maple, but all these characters, even if they were constant are probably not enough to maintain the two species independently.

This species differs from *R. fusca* Quél. which is similarly colored, in the spore ornamentation (spines more connected and lower in *R. fusca*).

Russula sphagnophila Kauffm., Rep. Mich. Acad. Sc. **11**: 86. 1909.

Syn.: *Russula sphagnophila* var. *europaea* Sing. Bull. Soc. Myc. Fr. **54**: 149. 1938.

Russula sphagnophila var. *americana* Sing., l. c.

Russula sphagnophila var. *subheterosperma* Sing., l. c.

Russula betulina Melz., Bull. Soc. Myc. Fr. **41**: 315, 1925, non Burl. (1915).

Russula abietina Peck, pro parte, Ann. Rep. N. Y. State Mus. **54**: 180, 1901, *nom. confus.*

Pileus very variable in color, "oxblood red" to "Vandyke red" with "diamine brown" (R.), sometimes partly bleached, and the center sometimes with black, brown, or olive tints, viscid and shining when wet, glabrous, smooth, not shining or slightly shining when dry, with the pellicle separable over one half to two thirds of the radius, with obtusely rounded margin which becomes sulcate early and remains deep and long tuberculate-sulcate, convex and often umbonate, soon depressed in the center and even then often with a slight umbo in the depression, sometimes umbilicate at the same time, eventually applanate to concave, 30—50 mm. broad. — Lamellae whitish, soon pale ochraceous "cream buff" to "maize color" (R.), not changing color on bruising, typically moderately close to distant, e. gr. 60—70 through-lamellae, more or less anastomosing, sometimes strongly forked, slightly ventricose and rather broad, sinuate-adnexed, attenuate-subdecurrent or subfree; spore print (D—)E when fresh, not darker, in herbarium eventually often reaching a tone between E (F) and G (Crawshay). — Stipe white, with a strong flush of pink or pinkish red either all over or, more often, over part of the surface, most frequently near the base, not tending to become yellow or gray

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but sometimes slightly banana-flesh color to glassy-hyaline-sordid near the base, subrugulose or rugulose, ventricose-subequal, ventricose or tapering upward, solid, soon spongy, 28—48 ⇌ 6—12 μ. — Context white, eventually sometimes light cream or glassy hyaline-sordid in base of stipe but not tending to become ochraceous yellow or brown, not graying, reddening, or otherwise changing color, soon rather fragile; taste mild; odor none.

Spores 8.5—9.7 ⇌ 7—8.5 or 9.5—13 ⇌ (7.5)8—9.5 μ, according to print, some macrospores up to 15 μ long, orn. 0.9—1.5 μ, of type IV and V in some prints many of type VI or III b present, always some with IV—II-lines or VI—VIII-chains present; basidia 28—44 ⇌ 8.5—14.2(15.5) μ; macrocystidia rather numerous, blue in SV, more rarely rather scattered, with abundant banded contents, fusoid-ventricose, often with very long appendages, 43—68 ⇌ 8.5—11.8 μ. Epicutis of pileus consisting of hyphae, and dermatopseudocystidia which are well individualized, bluing in SV, their basal portion often septate and constricted at septa, not all with banded contents, scattered to numerous, not very long if well differentiated, up to 10 μ broad; some scattered hyphal ends transformed into primordial hyphae and then slightly incrusted; all hyphae without clamp connections.

$FeSO_4$ on context of stipe reddish gray.

Among *Sphagnum* and on forest humus, in the first case often in pure coniferous woods, in the latter (more commonly) near *Betula* specc., fruiting from June until October. From Massachusetts to Michigan. Also in Europe and Northern Asia.

Material studied: Numerous collections from Asia (Altai Mts.), Europe (Sweden, U.S.S.R., Germany, Austria, Czechoslovakia). — U.S.A.: *N. Y.*, part of type of *R. abietina*, NYS. — Huntington Forest, Singer, 128 a, 115 a, FH. — *Mich.*, type MICH. — Luce Co., Tahquamenon Falls, Singer, N 1036, N 1034, MICH, F.

This is undoubtedly a circumpolar species. It was misnamed *R. paludosa* Britz. by Voile, *R. venosa* Velen. by Melzer and J. Schäffer and *R. roseipes* ("var.") by Cooke. It had been thought originally that the American type differs from the European species as described in the Monographs, by minor spore characters, but this is not the case. The present description is based on American material exclusively. Some specimens with lighter colored spore print are now considered by European authors to be different, and probably rightly so, yet, these are not identical with *R. sphagnophila* Kauffm. or *R. venosa*, the former being this species, the latter being a species of the deep-spored subsections, now difficult to interpret, but according to the description of the lamellae, the habitat and other characters undoubtedly not belonging to *R. sphagnophila*.

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The American collections show perhaps a slightly higher average of white-stemmed fruiting bodies than the European ones (although the type is pink-stemmed and white-stemmed mild specimens can be found in Europe likewise), and a larger number of spores with fine to coarse short connecting lines than the majority of the European collections, but we have seen material from Sweden with exactly the same ratio of ornamentation types as just mentioned, and, vice versa, some American collections show spores with predominantly isolated (or almost so) spores, including the type specimen. The attempt to separate the "American form" as a variety, has therefore been completely abandoned, and rightly so, J. Schäffer claims smaller spores for "authentic" material received from Kauffman, but there are only two possibilites: Either his measurements are in error, or else, Kauffman happened to send him a young, atypical, or otherwise different or misnamed specimen. The species is too frequent in the northern part of the country to have been overlooked; indeed, Peck named it *R. abietina* in New York, but unfortunately, his type collection is a mixed collection. Kauffman found it but rarely, because he, apparently, considered as *R. sphagnophila* only those specimens actually collected in *Sphagnum* beds, and with distinctly pink stipe and small size. In addition, the species becomes increasingly more common in the northern part of Michigan where Kauffman rarely collected. Smaller spored carpophores are occasionally observed, but without any clear limit in regard to the larger spored majority (for example my own collection HF 115, FH, has somewhat smaller spores than usual). But even in these, the height of the ornamentation is always sufficient to distinguish the specimens from *R. blackfordiae,* even in dried specimens. White-stemmed forms grade into the pink-stemmed forms within a single group in northern Michigan. In Europe, I found some white-stemmed groups which had a very slight acrid taste in young carpophores, although it seems that the white stipe, even in Europe, is not necessarily correlated with subacrid taste. No such correlation was ever observed in North American material. Those forms described by me as having white stipe and subacrid taste (from Czechoslovakia) belong obviously to a similar but different variety or species redescribed correctly by L. Blum as *R. sphagnophila* var. *subingrata* Sing. (Bull. Soc. Myc. Fr. **68**: 229, 1952). It has become clear to me that *R. sphagnophila* var. *heterosperma* Sing. is merely a form of *R. placita* Burl. (redescribed by me as *R. abietina* Peck, which was a misdetermination, (8) **54**: 157. 1938). *R. placita* is, in view of the existing descriptions, not redescribed here. Var. *subheterosperma* Sing. (8) represents the forms with more connected spines of the species described above, if one cares to separate them from the type.

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Russula blackfordiae Peck, Bull. N. Y. State Mus. **139**: 43. 1910.

Syn.: *Russula abietina* Peck (see under *R. sphagnophila* Kauffm., and notes below).

Russula versicolor J. Schaeffer, Zeitschr. f. Pilzk. **10**: 43. 1931.

Pileus very variable in color, from deep violet-purple to pinkish vinaceous and from carmin purple to deep red, also frequently with brownish shades intermixed, and often with some olive *) or with dull flesh pink color all over, e. gr. "wineberry", "chalet r.", "Spanish cedar", "cameo brown", "Ambrosia" center more brownish to grayish purple or olive shaded, e. gr. "Java" (M&P), smooth except for the margin which is smooth for a long time but becomes short sulcate to tuberculate- sulcate in age, with subacute to obtuse, or eventually rounded margin, usually distinctly paler colored than the rest of the pileus in the marginal zone, glabrous all over in all American collections viscid, shining or more often slightly shining with opaque center when dry, with half or entirely separable pellicle, convex, then applanate on margin, or convex with depressed center, often somewhat umbilicate when young or when mature, 30—55 mm. broad. — Lamellae whitish, soon light ochraceous, medium broad to broad (2—6.5 mm. or broader), not or only slightly ventricose, close, attenuate- subfree to adnexed, anastomosing; spore print E (Crawshay). — Stipe white, sometimes with some ochraceous brownish specks, usually becoming ochraceous or ochraceous brown from the base upward, rarely without any discoloration, but even then often slightly yellowing on handling, never tending to become gray, subrugulose, equal or tapering upward, solid, later somewhat spongy, 20—44 ⇌ 7—10 mm. — Context white, with a tendency to become ochraceous, rather firm, later spongy-fragile, slightly to distinctly but never strongly acrid, without odor, or with a very weak fruity odor.

Spores 7.5—9.8 (11) ⇌ 5—8.7 µ, either predominantly ellipsoid and not broader than 7.2 µ, or subglobose-short-ellipsoid, but often mixed in a single spore print, orn. 0.5—0.8 (1) µ, of type III a—III b (sometimes predominantly III a, sometimes mostly III b, but independently of the spore shape), always numerous spores with short ridges III b—II, IV—II, and a few with orn. IV or V present; basidia 4-spored, or rarely a few 3-spored ones intermixed, the latter bearing spores up to 11 ⇌ 7.3 µ, clavate or ventricose-clavate, 27—37 ⇌ 8.7—11 µ; sterigmata 3.5—6.8 µ; macrocystidia numerous, fusoid-

*) Only specimens with the above colors are considered here. The predominantly green forms considered identical by Melzer, J. Schäffer and myself, have lately been separated from this species by European writers, and I have no chance to revise the group in Europe in order to verify their identity.

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ventricose and attenuated but either rounded or subacute above, 30—66 ⇌ 6—11 μ with or without appendage (1—7.5 μ long), filled with banded contents at least in the upper half, but often all over and staining blue in SV, becoming less numerous and less abundantly stuffed with contents in older specimens, often uniformly rather short with rather long appendages on the edges of the lamellae and there some almost "empty"; epicutis of pileus with numerous clavate-elongate dermatopseudocystidia which become blue in SV, up to 100 ⇌ 6.6 μ and often long-appendiculate, with granular to banded contents, many with distinct septa and often constricted at the septa; surface of the stipe wih numerous similar dermatopseudocystidia.

$FeSO_4$ on context of stipe sordid salmon to reddish gray. — Alpha-naphthol on context reacting quickly and strongly. — Phenol chocolate.

In mixed woods and in pure birch woods, always with or near *Betula,* on the ground, rarely on rotten wood, singly or more often in groups. Fruiting in summer and fall. Massachusetts to Michigan and west to Montana but probably wider destributed in North America, not reaching Alabama or Florida; also in Europe, Asia.

Material studied: Numerous collections from Europe (Finland, Austria, Czechoslovakia, U.S.S.R., Germany, Sweden, France, Spain) and Asia (Siberia); U.S.A.: *Mass.*: type of *R. blackfordiae* Peck, FH, NYS. — *N.Y.*: Newcomb Co., Huntington Forest, Wolf Lake, Singer, FH. — Type of *R. abietina,* p. p., NYS. — *Mich.*: Cheboygan Co., Emmet Co., Presque Isle Co., Mackinac Co., Chippewa Co., Luce Co., very common in summer 1953, Singer N 238, N 540 a, N 911, N 1112, N 1273, MICH, F. — *Ma.* Echo Lake, Flathead National Park, C. H. Kauffman MICH.

This species was known in Europe as *R. serotina* Quél. (so in Melzer & Zvára's and the author's monograph), but the identity of this earliest epithet is controversial, and its interpretation in the sense of these authors cannot be backed up with type specimens, since none exists. *R. abietina,* type sheet, is partly this, a mixed collection, also containing *R. sphagnophila,* white-stemmed carpophores. *R. blackfordiae* Peck, however, is undubitably this species as described above; since the description given is based exclusively on American material, it can be compared with the modern descriptions of European collections. A painting has been deposited at the University of Michigan Herbarium.

Russula cristulispora Sing., Not. Cryptog. Sect. Crypt. fasc. **10—12**: 7. 1938.

Pileus varying from deep purplish lilac to dull purple on margin and always deep brown red to blackish in the center, sometimes with

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pallid areas, glabrous, viscid, shining or partly dull when dry, with thin, subobtuse (not rounded) smooth, eventually slightly sulcate or short to medium long sulcate margin, convex, eventually partly depressed, flattened, 30—50 mm. broad. — Lamellae pale cream color, then cream ocher, light ochraceous yellow, attenuate-subfree, mostly equal and simple, narrow (3 mm.), close to crowded, sometimes with conspicuous rectangular (ladder-like) anastomoses; spore print neither white nor deep ochraceous, not obtained in sufficiently thick layer. — Stipe white, becoming slightly ochraceous brownish in cortex when touched and dried or with rusty specks near the base or else remaining white, never becoming gray, subrugulose, stuffed, subequal or attenuate upward, rather thin in most specimens, 20—45 ⇌ about 8 mm. — Context white; taste slightly acrid to submild; odor none.

Spores 6—9 ⇌ 5.5—8, but occasionally some up to 11 μ long and 10.3 μ broad, subglobose or some ellipsoid, orn. 0.2—0.8 μ, of type II (II—III a, II—III b, II—IV), few spores without cristulation and then III a, III b; basidia 30—48 ⇌ 8—14 μ, 4-spored; macrocystidia fusoid, numerous or moderately numerous, with banded contents and blue in SV, 40—68 ⇌ 6.5—10 μ, not or moderately projecting and not very conspicuous in most collections, subacute or obtuse, appendiculate or not, with short appendages (where these are present), often yellowish inside; epicutis of pileus with numerous cylindrical to clavate or subcapitate-subfusoid dermatopseudocystidia which are either entire or septate with constricted septa, bluing in SV, originating in normal filamentous hyphae of the epicutis, 50—100 ⇌ 6—8 μ; dermatopseudocystidia also numerous on the surface of the stipe.

In boreal and subalpine localities on the ground near *Betula* specc. including "herbaceous" birches (*B. papyracea* var. *minor* etc.), often in mixed coniferous stands near *Betula*. Fruiting in summer and fall. Caucasus, Nothern Europe, White Mountains, Adirondack Mts.

Material studied: Caucasian National Park, West-Caucasus, L. N. Vasilieva, 8-44-48, type, LE, KAZ. — Sweden, Munkön, comm. Haglund, S. — U.S.A.: *N.H.*: Amanoosuc Trail below the Lake of the Clouds, Singer W 17, FH. — *N. Y.*: North Elba, C. H. Kauffman, (as *R. turci* Peck), probably this, MICH.

This species is apparently very close to *R. blackfordiae* from which it differs in a series of minor characters, mainly, however, in the ornamentation of the spores. The main missing character is the exact color of the fresh spore print. A careful comparison of the spores of typical *R. blackfordiae* from the United States and from Europe (*R. versicolor* of *Russulae Exsiccatae* distributed by J. Schaeffer) shows that the spores of *R. cristulispora* are always

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distinguishable. In specimens of *R. blackfordiae* with shorter spores (e. gr. Singer 8—112 from Europe), the ornamentation is always distinctly less crested or not crested at all. If the spore color should turn out to be somewhat lighter than in *R. blackfordiae,* this would establish a second diagnostic character for the species.

Sebsection *Integrae* R. Maire.

Russula beardsleei Burl., Mycologia **31**: 492. 1939.

Pileus "peach red" (Repertoire des Couleurs, sec. Burlingham), in our specimens "flesh color" to "Congo pink", mixed with "deep colonial buff", "warm buff", "cartridge buff", "light buff", on the center also "Naples yellow" (R.), the pinkish to pale brick color remaining longest in the marginal zone (but not always so: sometimes dotted), glabrous, viscid when wet, with the cuticle separable part way to the disc or almost entirely, opaque when dry, with obtuse margin which is smooth at first but becomes — not very strongly — short sulcate-tuberculate, convex, soon depressed in the center, eventually subapplanate in the marginal zone and umbilicate to depressed in the center, 35—75 mm. broad. — Lamellae cream color to light ochraceous, moderately close to crowded, anastomosing, broad (4—7 mm.), simple or mostly simple, equal or with a few lamellulae, rounded-free or attenuate-subfree, more rarely with a decurrent tooth; spore print "honey yellow, tone 1" (Rep. d. couleurs, sec. Burlingham), exactly E or E with a hue of F (Crawshay) in our specimens. — Stipe white, glabrous, equal or slightly tapering upward or thickened at the apex, solid then stuffed, 23—60 ⇌ 9—18 mm. — Context white, unchanging, taste from mild to slightly and slowly acrid in young and fresh specimens, "bad" sec. Burlingham; odor none.

Spores 9.3—11.7 (12.2) ⇌ 6.5—7.5 µ, i. e. ellipsoid but varying from as elongated as 11.5 ⇌ 7.5 µ to as short as 9.3 ⇌ 7.5 µ, finely granularly ornamented, of type VII, III a, with some broader lines (II) or some catenulate rows (VIII), only about 0.3 µ high or lower; basidia 34—48 ⇌ 11 µ, clavate; macrocystidia blue in SV about three quarters of their length from the tip downward, with banded hyaline to yellowish contents or a few "empty" hyaline ones intermixed, usually tapering from the apex downward or ampullaceous to apiculate, 41—70 ⇌ 8.8—13.5 µ; edge of lamellae homomorphous to almost subheteromorphous, i. e. the same kind of cystidia seen at the edges as on the sides of the lamellae, only there are comparatively fewer „empty" ones seen on the sides, and more bluing ones on the edges; subhymenium thin, cellular; hymenopodium filamentous, well developed; epicutis of pileus consisting of a trichodermium of slightly interwoven hyphae imbedded in a gelatinous mass, many

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of the terminal members transformed into bodies intermediate between primordial hyphae and ciliate dermatocystidia and some of the broadest terminal members often filled with loose banded or subgranular contents, 40 ⇌ 4—6 μ, versiform, loosely granularly bluing in SV, the "empty" terminal members not bluing and about 3—4.5 μ thick; oleiferous hyphae also present and bluing in the same manner as the dermatopseudocystidia; hypodermium consisting of interwoven filamentous hyphae forming a cutis; all hyphae without clamp connections.

$FeSO_4$ on context of stipe "fawn color" to "avellaneous" (R.).

Under *Quercus* on sandy ground, fruiting from July until November. Florida.

Material studied: Alachua Co., Gainesville, Singer F 2773, FH. — Sugarfoot Hammock, Singer F 2556, FH.

The type of this species has not been restudied, but the species is so characteristic that there can be no reasonable doubt about the identity of the material studied with the original specimens. The type came from Longwood, Fla. This is the only red, ocherspored species with conspicuously elongated spores. Aside from these spores, it is close to the *R. integra* complex.

Russula flaviceps Peck, Ann. Rep. N.Y. State Mus. **53**: 843. 1900.

Pileus yellowish with some red intermixed, with lemon colored dots, much like some paler colored forms of *R. maculata,* or just pale yellow all over, glabrous, viscid, smooth but with coarsely tuberculate-striate margin, with the cuticle separable part way to the center, with obtuse margin, convex or with depressed center, 50—100 mm. broad. — Lamellae pale cream color, then pale ochraceous, equal or subequal, moderately broad to broad, simple or with a few forked ones, attenuate toward the stipe; spore print between D and E and remaining so in the herbarium, definitely lighter colored than in *R. aurantiolutea.* — Stipe white, equal, or almost so, glabrous, subrugulose to smooth, stuffed, 35—70 ⇌ 9—20 mm. — Context white, unchanging or becoming slightly cinereous in the cortical layer of the stipe; taste fishy, slightly disagreeable, slightly bitterish in old specimens, perhaps slightly acrid when quite young; odor fruity, somewhat like bananas.

Spores about 10.5 ⇌ 8 μ, orn. 0.3—1.5 μ, mostly 0.6—1.2 μ, of type II, III a, or only II; basidia 4-spored; macrocystidia blue in SV down to about their middle or less, moderately numerous, versiform; epicutis of pileus with dermatopseudocystidia much like oleiferous hyphae in aspect, very long, with banded contents and bluing in SV, moderately numerous.

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$FeSO_4$ on context of stipe salmon color. — Formalin on context of stipe negative.

In low mixed (pine and oak) forest on the ground, fruiting in summer, Massachusetts to Vermont and New York.

Material studied: *Mass.*: Purgatory Swamp, Singer, FH. *Vt.*: Newfane, Hibbard, det. Burlingham, Herb. Boston Mycol. Cl. FH. — *N.Y.*: authentic material, Patouillard Herbarium, FH.

This has the colors of older specimens of *R. humidicola* Burl. in many instances, but is much stouter and has deeper colored spore print. It is represented by several specimens in the Albany Museum (NYS) but these do not fully coincide with the original description, and it was at first assumed that Peck called *R. flava,* if the blackening had been overlooked, *R. flaviceps,* especially since one specimen was found to be *R. flava* which was labeled *R. flaviceps* by Peck. However, Miss Burlingham stated that she had seen the type (which cannot be located at Albany), and it must be assumed that the holotype has been lost. Miss Burlingham's collection from Vermont was studied, and found to be identical with authentic (det. Peck) material in the Patouillard Herbarium, and it appears that this interpretation also closely coincides with Peck's short description so that the present interpreation is well documented and forceful. The species seems to be rather rare.

Subsection *Alutaceinae* Melzer & Zvára.

Russula murrillii Burl., Mycologia **5**: 310. 1913.

Pileus "deep livid brown" to "dark nigrosin violet" on the disc, lilac to "Chinese violet" or "deep brownish vinaceous" (R.) on the marginal zone, sometimes olive blackish in the center, in dried material greenish tones often becoming visible, pruinose at least on the disc, glabrescent on the margin, slightly to distinctly viscid in very wet weather, but drying out rapidly, smooth all over, with rounded margin, convex, then depressed in the center, 50—100 mm. broad. — Lamellae white, then pale yellow, close to subdistant, broadest near the margin, veined in age, a few forked near the stipe, equal, rather broad, narrowed-adnexed at the stipe; spore print in the deepest prints between D and E (Crawshay). — Stipe white, mealy-opaque, glabrescent, subequal, 30—50 ⇌ 8—30 mm. — Context white, unchanging, not very elastic, firm and eventually fragile; taste mild; odor not observed.

Spores 8.3—12 ⇌ 6.7—9 μ; orn. 0.3—0.7 μ, of type II—III b, II—IV, some III a; basidia 35—49 ⇌ 11—17 μ; cystidia with a triangular body at the apex (just as *R. punctata*), the latter turning blue in SV, versiform; epicutis of pileus with very numerous primordial hyphae with rounded tips, 2.5—7.5 μ broad; dermatopseudocystidia none.

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On the ground in coniferous woods (under *Pseudotsuga, Tsuga mertensiana, Chamaecyparis nootletensis,* etc.) in groups, fruiting in fall. Washington and Oregon.

Material studied: *Wash.*: Lake Cushman, C. H. Kauffman, LE, MICH. — Marysville, J. M. Grant (as *R. xerampelina*), Herb. Grant, FH. — Lake Crescent, Sept. 24, 1935, A. H. Smith, FH. — Deer Lake, Olympic Mts., A. H. Smith 2684, FH. — Mt. Angeles, Olympic Mts. A. H. Smith 17412, FH. — *Ore.*: Rhododendron, Gruber, comm. A. H. Smith 20257, FH. — Corvallis, Murrill, det. Burlingham, NY, type.

This is microscopically so close to *R. punctata,* the type was at first interpreted as probably identical with *R. punctata.* However, it was later found that "pale-spored *R. punctata*" actually exists in the Northwest, and the species seems to be constantly different. The additional data were obtained from careful spore prints and notes by A. H. Smith who also published a colored slide of this species in his "Mushrooms in their Natural Habitat" (9).

Russula dadmunii Sing., Sydowia **2**: 39. 1948.

Pileus pink "withered rose" to "tanagra", rarely with "Martinique" to "mummy" shades, the margin always "withered rose" (M&P), granular-rimulose or innately subgranular-pruinosulous, viscid in very wet weather but drying out very rapidly, with smooth, rounded margin, later with very slightly sulcate margin, convex, with depressed center, eventually concave, 30—65 mm. broad. — Lamellae ochraceous, broadest in the marginal third (5—6 mm.), attenuate toward the stipe, very few forked or intermixed, subclose, anastomosing; spore print distinctly deeper than E (Crawshay). — Stipe white, somewhat sordid when touched, usually as long or longer than the diameter of the pileus, equal or subequal, spongy-stuffed, eventually hollow. — Context white, unchanging: taste mild; odor

Spores 7.5—10 ⇌ 6—7.5 μ, orn. III a, VIII, II; connecting lines of iodoform in the base of the stipe.
and warts in an average rather coarse; basidia 4-spored; cystidia moderately numerous or almost sparse, only at the apex turning blue in SV, as in *R. punctata* and *R. murrillii),* very many of these, at least at the edge of the lamellae, with short to often very long appendages (10—23 μ); edge of lamellae subheteromorphous to homomorphous; epicutis of pileus consisting of primordial hyphae; no dermatpseudocystidia; stipe also with primordial hyphae in its surface layer and devoid of dermatopseudocystidia.

SV on dried stipe not reddening. — Metol on flesh: slow and weak reaction.

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On the ground, always with *Tsuga canadensis,* forming mycorrhiza with hemlock exclusively. Fruiting in summer. Massachusetts to Michigan.

Material studied: *Mass.,* type and paratype, FH. — *Mich.*: Cheboygan Co. Douglas Lake, MICH, CF.

This species in closely related to *R. punctata* but differs mainly in the color of the pileus and the mycorrhiyal partner.

Russula roseipes ssp. **thermophila** Sing. ssp. nov.

A *Russula roseipes* ssp. *roseipede* et ssp. *dictyospora* Sing. differt stipite frequentius albo; sporis elongatioribus. Sub *Pino taeda,* Florida, Singer F 2682, typus.

Pileus pink: "orient pink", "grenadine pink", "light coral red" (R.), pallid spotted or pallescent, subviscid ne wet weather but drying rapidly and usually found dry, minutely granularly-subareolate to subglabrous, never distictly and completely glabrous, with the cuticle sometimes pulled back from the margin as in *R. vesca,* and completely separable, with smooth, obtuse margin, convex, then depressed, 25—52 mm. broad. — Lamellae ochraceous, flat below, anastomosing, subclose, simple, equal or with few lamellulae, medium broad (5 mm.), attenuate-attingent at the stipe or free to adnexed; spore print G (Crawshay). — Stipe white, more rarely with pinkish areas, on drying at times argillaceous, rugulose or subrugulose, stuffed, equal, 28—34 ⇌ 11—13 mm. — Context white, unchanging; taste mild; odor none.

Spores 8.5—11 ⇌ 6.8—7.8 μ, orn. 0.3—0.6 μ, of type III b, IV, but most frequently with crested and catenulate rows (VI—VIII, III b—VIII, IV—II, II), very rarely III a, never V, VI; basidia 27—45 ⇌ (8) 11—15 μ, clavate, 4-spored; cystidia very frequently without any contents, some with very scattered granular or banded contents, ventricose in the upper portion, acute or appendiculate (appendage up to 7 μ long), 34—77 ⇌ 6.8—13.6 μ; edge of lamellae subheteromorphous: cystidia on edge numerous to very numerous, on sides scattered or less numerous; epicutis of pileus consisting of interwoven scarcely gelatinizing hyphae, the terminal members often pilose or cystidioid, but never with any contents, others with incrustation and not thickened (the majority), apparently primordial, the cystidioid hyphae few, up to 6.5 μ broad, dermatopseudocystidia none; hypodermium consisting of a cutis of filamentous hyphae, pigment dissolved, intracellular, and partly solid, red, amorphous, in ammonia mounts not persistent; surface of stipe like cuticle in structure, with somewhat more thickened primordial hyphae, without dermatopseudocystidia.

On the ground on sandy soil under *Pinus taeda,* fruiting in summer, North Florida.

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Material studied: Alachua Co., Gainesville, Singer F 2682 (type), F 2683 (paratype), FH.

This has the appearance and pinophilous habit af *R. roseipes,* but differs from the known races of that species in having more elongated spores and more frequently white stipe. Since the other races of *R. roseipes* are rather subboreal to montane, this is apparently a thermophilous race of the same species. Ssp. *dictyospora,* the North American-Asiatic race, has been observed frequently in the Altai Mountains west to Tataria, in the White Mountains, N. H., at the tree line, and in Michigan (numerous collections, MICH, CF). The species differs from *R. amygdaloides* and *R. lutea* in having no dermatopseudocystidia on the stipe.

Russula amygdaloides Kauffm., Agar. Mich. **1**: 162. 1918.

Pileus red to pink: young "crab apple" with "Monterey" center, then pl. 2 C 11, "flash", "cherub", "peach bloom", "brick dust", "autumn glory" (M&P), "coral pink" (R.), sometimes with deeper colored spots, sometimes paler ("bois de rose" M&P), often mixed with ocher on the margin and the center either concolorous (pink-red) or ochroceous buff to yellow, sometimes with ocher pallid areas, in rainy weather very viscid, but drying out very rapidly, and then almost subpruinose and completely opaque, never shining anywhere, smooth, with smooth, eventually sometimes sulcate margin, with the pellicle separable part way to the center, with rounded margin, convex, then with depressed center or convex-applanate-subumbonate, not rarely inequilateral, 40—67 mm. broad. — Lamellae ochroleucous, then bright ochraceous (Crawshay no. 3 with a reflex of no. 9), eventually color of spores, slightly ventricose, or flat below, moderately broad to broad (6—7 mm.), moderately close to close, anastomosing, equal, somewhat forked, sinuate; spore print G (Crawshay). — Stipe white, rugulose, tapering upward or downward, 30—50 ⇌ 17—22 mm. — Context white, unchanging, rigid-fragile: taste mild or very slightly acrid in the very young and fresh caps, odor none.

Spores 8.8—10.5 ⇌ 6.8—9.7 μ, orn. 0.7—1.9 μ, of type IV and IV—II, occasionally some spores of type V, VI, VIII present; basidia 40 ⇌ 13.5 μ, 4-spored; macrocystidia moderately numerous to numerous, with banded contents in the middle or almost all over and accordingly bluing in SV, versiform, 9.5—10.3 μ broad; edge of lamellae homomorphous; epicutis of pileus consisting of "empty" in crusted primordial hyphae forming almost a palisade but the terminal cells often rather short clavate to almost vesiculose, erect, seemingly cellular when seen from above (as if composed of round bodies, in scalp preparation), 7 μ in diameter (clavulae from 4.2 to 10.2 μ broad,

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hyaline); hypodermium forming a cutis of somewhat interwoven yellowish hyphae (KOH), between this and the epicutis a layer of pink hyphae; on the surface of the stipe numerous or more often moderately numerous bluing (in SV) dermatopseudocystidia of the macrocystidia-type, 7.3 μ broad.

On the ground in frondose and mixed woods under *Quercus,* in small groups or solitary, fruiting from June until October. Massachusetts to Michigan.

Material studied: *Mass.*: Arlington, R. & H. Singer, FH. — *Mich.*: Ann Arbor type of *R. amygdaloides,* Oct. 5, 1910, MICH. — Douglas Lake and Burt Lake region, Cheboygan Co., Singer N 216, N 217, N 216 a, N 302, N 401, N 555, N 448, N 604, MICH, F.

This species is not rare and represents the only species without dermatopseudocystidia on the pileus, with dermatopseudocystidia on the stipe, with pink (like *R. roseipes)* to bright red pileus and white stipe and groving under oak, having spore print G, and showing neither bitter nor strongly acrid taste. The predominantly pink form of *R. lutea,* rare or absent in North America (f. *luteorosella* Britz.), cannot be confused with *R. amygdaloides* because of less opaque, completely glabrous pileus, the shades of pink and red on the pileus, the less completely bluing macrocystidia of the hymenium, and the constantly absolutely mild taste of the context. Nevertheless, *R. lutea* is the species, closest to *R. amygdaloides.* The yellow forms of *R. lutea* are not uncommon in the Northeast west to Michigan and probably further west, but sometimes the spores are conspicuously crested as in *R. lutea* var. *subcristulata* Sing. from the Caucasus. Whether or not this "variety" can be separated from *R. lutea* var. *lutea* on the basis of correlated characters depends on more detailed studies. Until now, the form has been found only twice. A redescription of the well-known *R. lutea* is hardly necessary inasmuch as it has been described in detail in the current European monographs (4, 7).

Subsection *Rubrinae* Melzer & Zvára.

Russula tenuiceps Kauffm., Rep. Mich. Acad. Sc. **11**: 81. 1909.

Pileus "pomegrenate" to "ember" or the two colors mixed (M&P), or "India r.", "rosevale", "ember", "autumn glory", "chianti", "Maroccan r.", "Algerian r."'"chimney r." (M&P), "brick red", "coral pink" with "Pompeian red", or (from margin to disc) "light coral red", "coral red", "Pompeian red" (R.), often with a yellowish ("Saratoga" M&P, or paler) ground, and often with pallid to "Saratoga" spots or disc, sometime "vinaceous tawny" (R.) almost all over, with subpruinate to pruinate or at least slightly roughened surface, the

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bloom later disappearing and pileus glabrescent, with the cuticle separable over one third to more than three quarters of the radius, subviscid when wet but drying out rapidly, extremely opaque in the center, opaque or vaguely shining on the margin, smooth or subrugulose, with smooth margin which is subacute at first but becomes subobtuse to rounded in age, often short to very short sulcate in age, convex, then with depressed center, eventually applanate to concave with strongly depressed center, 42—115 mm. broad. — Lamellae whitish, soon light ochraceous (of the shade of the lamellae of *R. integra* or *R. paludosa*, i. e. Crawshay no. 8—9), with few forked ones, equal, or with a few lamellulae present, narrow, or rather broad (7—10 mm.), close to moderately close, little anastomosing, adnexed; spore print E to G, sometimes rather exactly E and sometimes reaching G (Crawshay). — Stipe white but usually much or most of the surface flushed with pink (a vivid pink, pl. 1 I 3 to "eosin pink" M&P) due to a pink pruina, glabrescent but remaining pink, subrugulose, solid, then stuffed, slightly attenuate at the very base or swollen at the base and tapering upward, or else equal to ventricose, 30—85 ⇌ 14—23 mm. — Context white, somewhat colored with the pigment of the cuticle underneath the latter, unchanging, thin in the marginal zone of the pileus, spongy but firm, later fragile; taste very slowly but extremely strongly burning acrid (as in *R. badia*), and, in some collections at the same time slightly to distinctly bitter; odor none, or slight (of crème Chantilly, or of pears).

Spores (7) 7.4—9 (10) ⇌ (5.8) 6.5—8.3 μ, orn. up to 1.3 μ, usually around 1 μ, of type IV, III b, some spores with type II or IV—II or VIII, with the connecting lines very fine to rather coarse, also some spores with orn. VI or V in some specimens, very rarely some VII; basidia 30—50 ⇌ 10—14.3 μ, 4-spored; macrocystidia numerous, fusoid, or more rarely subcylindric, subobtuse, sometimes short-appendiculate, with abundant banded contents, blue in SV, 60—78 ⇌ 6—13 μ; epicutis of pileus with numerous to extremely abundant, usually voluminous cylindric to more often clavate dermatopseudocystidia which are up to 166 μ long and 6.8 ⇌ 11 μ broad, bluing in SV; oleiferous hyphae often very thick and numerous; covering layer of stipe with numerous to extremely numerous dermatopseudocystidia of the same type as on the pileus, perhaps less often septate, bluing in SV.

$FeSO_4$ on context of stipe grayish reddish.

On the ground under *Tsuga canadensis* in mixed woods, sometimes in pure hemlock stands, gregarious, fruiting in summer and fall, from New England west to Michigan, and probably south to the Carolinas.

Material studied: *N. H.*: Linder, det. Singer, FH. — *Mass.*: Harvard, Singer, FH. — Purgatory Swamp, Singer, FH. — Ar-

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nold Arboretum, Jamaica Plain, Singer, FH. — *Mich.*: Type and authentic material by C. H. Kauffman, MICH. —Emmet Co., Maple River, Singer N 884, MICH, F. — Luce Co., Tahquamenon Falls State Park, Singer N 993, N 1038, MICH, F.

R. tenuiceps in close to *R. badia* Quél. but differs in the characteristic color of the pileus (less purple), odor, taste, and habitat. Since *Tsuga* is absent in Florida as well as in Europe, it does not occur there.

Sebsection *Chamaeleontinae* Sing.

Russula admirabilis Beardsl. et Burl., Mycologia **31**: 493. 1939.

Pileus "coral pink" with cream whitish or pallid portions, partly, especially on or near disc, becoming "light jasper red", "jasper red", "pompeian red", or rarely even "madder brown", the margin remaining "coral pink" or becoming "light jasper red" (R.), eventually partly bleaching in some individuals, opaque, viscid, when wet, drying out rapidly, occasionally with a faint bloom, with obtuse or rounded margin which is even or short-tuberculate-sulcate, with separable cuticle (sometimes easily separable all over the pileus, sometimes only part way to the center), sometimes subrimulose near the margin, convex, then convex-umbilicate, the convex-applanate with depressed center, eventually irregularly flattened, 27—57 mm. broad. — Lamellae white, then cream color, then light ochraceous, eventually in the color of the spores, rather narrow to broad (3—8 mm.), ventricose or not, broadest in outer third, rarely in the middle, attenuate-free to rounded-free, rather close, anastomosing, some bifurcate near the stipe, otherwise simple, all equal or exceptionally with a few lamellulae; spore print G when fresh, but in the herbarium fading to E (Crawshay). — Stipe white, sometimes becoming slightly sordid-grayish over part of the surface as in *R. nauseosa,* not tending to become yellowish, subrugulose, solid, then stuffed and soft, eventually stuffed-subhollow, equal or with somewhat acuminate base or tapering upward, 20—40 ⇌ 6—17 mm. — Context white, rather fragile, soft in the stipe when old, unchanging; taste moderately to very slightly acrid when quite young and fresh, at least in the lamellae, later absolutely mild; odor none.

Spores 7.5—11.7 ⇌ 6.8—10.3 μ, orn. 0.4—1 μ, mostly about 0.7 μ, of type III b, often with short rows (III b—II, IV—II, VIII—VI, VIII—III b), much fewer of type III a or IV; basidia 4-spored; macrocystidia scattered to moderately numerous, with banded contents almost all over or more rarely only 14—29 μ from apex down and bluing in SV in the corresponding zone, often with a blue body of condensed contents (10—17 μ long), more rarely some scattered gra-

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nules below, sometimes only these granules present, rarely the bluing part in the middle of the cystidium, versiform, 45—52 ⇌ 5.5—8.7 μ; edge of lamellae homomorphous; epicutis of pileus consisting of hyphae and dermatopseudocystidia of the macrocystidia-type, the latter entirely blue in SV, but varying from rather scattered to numerous and often septate and not very broad, e. gr. 54—58 ⇌ 4—8 μ; some of the hyphae somewhat pilose at the ends but mostly obtuse, some forming transitions to dermatopseudocystidia; dermatopseudocystidia also observed on surface of stipe; hyphae without clamp connections.

$FeSO_4$ on context of stipe grayish reddish, more salmon in cortex, more gray-drab in core. — Phenol on context chocolate. — KOH on surface of pileus somewhat bleaching, in very fresh material slightly staining yellowish, but very weak reaction. — Formalin on context of stipe "vinaceous buff" to "light cinnamon drab" (R.), but only on the very surface layer, otherwise negative.

Under *Pinus australis, P. taeda,* and perhaps other species of pine on sandy soil, among grasses. Fruiting in winter, gregarious. Florida; also introduced with pine plantations in other warm regions, e. gr. Jamaica, B. W. I.

Material studied: *Fla.*: Gainesville, Alachua Co., Singer, F 1639 x, F 1639 a, F 1639 b, F 1639, F 1724 a, FH. — Authentic material of *R. admirabilis* (inserted, 1943, with *R. ochrophylla),* FLAS. — *Jamaica,* B. W. I., Cinchona, Blue Mountains, Dennis J 6, det. Singer, K, LIL.

This species is characteristic for the thermophilous but winter-fruiting *Russula*-flora, and has the bright rose red to red pileus, the presence of macrocystidia on pileus, stipe and lamellae, the deep ochraceous, but fading, spore print, white stipe, and partially reticulate spores as main characters. The species closest to this, and most similar, is *R. praefragilis,* see below. Other Floridian species of this group are an apparently new species (*R. elongatipes* Sing., in herb.) which differs in crested spores, and another species with crested spores, *R. subluteobasis* Murr., see below. *R. laeta* J. Schaeff. from Europe, also appears to be related to this group.

Russula praefragilis Murr., Lloydia **8**: 269. 1945 (1946).
Syn.: *Russula testaceiceps* Murr., l. c., p. 272.

Pileus "eugenia red", "jasper red", or "jasper red" mixed with "Pompeian red", in the center of most specimens "acajou red" and often reaching "madder brown" (R.), the red usually completely disappearing in dried specimens and becoming more purple with purplish black center, dull opaque when dry, glabrous, subglabrous or slightly punctulate-subrivulose on the margin, with easily

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separable cuticle (up to four fifths of the radius), viscid when wet but drying out rapidly, hemispherical, then convex, then with a depression in the center and eventually often concave, with rounded margin which is smooth in the beginning but becomes tuberculate-sulcate later on, 22—50 mm. broad. — Lamellae pale yellowish to ochroleucous or ochraceous, simple, more rarely many forked, equal, more rarely with many lamellulae, medium broad to broad; spore print variable between, E, F and G when fresh, but after complete dehydration in the herbarium paler; E or E—F (Crawshay). — Stipe white, not tending to become yellowish or cinereous, fragile, soft, easily crunched, mostly equal, 23—41 ⇌ 5—13 mm. — Context white, unchanging, with a very slight acrid aftertaste when quite young, inodorous, fragile.

Spores 8.2—11 ⇌ 6.8—9.5 μ, mostly 8.2—10.2 ⇌ 7.5—8.2 μ, orn. 0.7—1.2 μ, of type III b, sometimes also with some spores of type IV or III a intermixed, very few of type V and warts sometimes (but never predominantly) in rows (II or VIII), warts variable in shape; basidia e. gr. 46 ⇌ 13.3 μ, 4-spored, often abnormal in shape in many carpophores; macrocystidia with banded (not only at the apex), or granular contents, or "empty", ventricose in the upper half, with mucronate or appendiculate apex (appendages up to 11 μ long), 40—96 ⇌ 7—12 μ, usually 44—72 ⇌ 7.5—10.2 μ, very scattered on the sides of the lamellae but rather numerous at the subheteromorphous edge; epicutis of pileus with moderately numerous but not striking (in radial section easily overlooked) dermatopseudocystidia which often resemble those of *R. placita* (being septate and with loose contents), but in others non-septate in their majority and then versiform, mostly ventricose, narrowly clavate or subcylindric, sometimes mucronate, with scattered banded to granular contents, and often some similar bodies entirely "empty", moderately broad, intermingled with the hyphae, these erect, flexuous or ascending, curved, acute or obtuse, 2.8—4 μ broad, in some specimens some having a resinous incrustation, also some hyphal ends resembling ciliate dermatocystidia, all these bodies together forming a trichodermium which is hyaline; hypodermium formed by a cutis of hyphae which are red from a dissolved intracellular pigment.

Under oak, especially *Quercus laurifolia,* fruiting from May until August, Florida.

Material studied: Alachua Co., type of *R. praefragilis,* and type of *R. testaceiceps* Murr., FLAS. — S i n g e r, F 1995, F 2033, FH. — Highlands Co., Highlands Hammock State Park, S i n g e r, F 236, FH.

This species differs from *R. admirabilis* in the slightly more purple pileus, especially in dried material, slight differences in the spore characters, appearance in summer and with oaks, instead of in winter and with pines.

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Russula subluteobasis Murr., Lloydia **6**: 218, 1943.

Pileus a very pale pink mixed with a very pale yellow, with the general impression of "apricot buff" or "onion skin pink", some places "light coral red", some yellow, in dried condition more purple like some specimens of *R. praefragilis,* glabrous or subglabrous, viscid when wet, drying rapidly and becoming opaque, with rounded, in mature specimens sulcate margin, convex, then depressed, 30—32 mm. broad. — Lamellae pale ochraceous to ochraceous, rather broad (4 mm.), close, attenuate toward the stipe, equal or subequal, simple or almost simple; spore print G when fresh, becoming E (Crawshay) when dehydrated in the herbarium. — Stipe white, with some yellowish brown spots when dried, subrugulose, stuffed, slightly tapering upward, 40—50 ⇌ 7—11 mm., at the apex never broader than 5.5 mm. — Context white, unchanging, mild, inodorous.

Spores (from print) 8.2—10.2 ⇌ 7.5—8.5 μ, orn. 0.6—1.7 μ, of type II, but more often with short ridges (IV—II) than with long ridges (II—III b) always with accompanying very thin connecting lines forming a complete or incomplete network (III a—III b, if the II-ridges are neglected), besides often with catenulate rows (VIII); basidia 27—30 ⇌ 11—12 μ, short, ventricose, 4-spored; cystidia with finely banded contents all over, more rarely only in parts, mostly ventricose, with the broadest portion in the upper third, often with a short appendage, 37—44 ⇌ 7—10.5 μ, numerous; epicutis of pileus with numerous narrow and few broad (5.5 μ diameter) dermato-pseudocystidia with banded to amorphous contents, ordinarily only 2.5—5 μ broad, the broader ones usually septate; hypodermium consisting of filamentous hyphae forming a cutis, with intracellular salmon colored dissolved pigment (NH_4OH).

On the ground in high hammock vegetation under *Quercus,* spring, and summer, North Florida.

Material studied: Alachua Co., Magnesia Springs, Murrill, type, FLAS. — Gainesville, Singer, F 2001, F 2001 a, FH.

The discription given above is drawn from the author's collection exclusively. Murrill's type specimen was slightly larger (5 cm. pileus diameter; stipe 60 ⇌ 10 mm.). The stipe was slightly yellow at the very base (hence the name). This differs from *R. praefragilis* in several minor characters and the distinctly different spore ornamentation.

A similar species was discovered by the author (*R. elongatipes* Sing. in herb.) which differs in more elongate stipe, the absence of any yellow on the stipe, in low hammock, in summer, Highlands Hammock State Park, Highlands Co., Fla. Singer, F 167, FH. We refrain from describing it as new at this time, since the differences between this and some other forms with more catenulate spores on

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one hand (there stipe often pink, *R. catenulata* Sing. in herb.) and *R. subluteobasis* on the other hand are rather small and in need of a recheck as far as the correlation of these characters is concerned. In difficult groups like this, a larger number of collections is desirable. At present, there is still some suspicion as to the possible identity of some of these species with *R. subluteobasis* which would then include specimens with somewhat more vividly colored pilei, with larger diameter and longer stipes.

Russula cessans Pearson, The Naturalist (1950): 101. 1950.

Pileus dull vinaceous purple to purplish crimson, often with olive color between the margin and the disc which is either brown or blackish purple, the purple e. gr. "carbuncle" to "mirador" (M & P), viscid, at least when young, and sometimes very viscid, slightly shining to opaque on the margin and subopaque to shining in the center when dry, with the pellicle peeling about one half of the radius, with obtuse to mostly rounded smooth margin which usually becomes tuberculate-sulcate in age, sometimes inconspicuously, sometimes conspicuously so, convex, soon with depressed center, very frequently and almost characteristically subumbonate to umbonate in the depression, occasionally becoming slightly and finely rimulose in the marginal zone, 20—46 mm. broad, sometimes reaching 68 mm. — Lamellae whitish, then cream color, then yellow to ochraceous, crowded to subdistant, most frequently close to subclose, simple or occasionally forked, equal, or rarely with few lamellulae, narrow to medium broad (not broad), usually 2—4 mm. broad in specimens 20—36 mm. broad, slightly broader in larger caps, adnexed-subfree, attenuate-free or rounded to emarginate, anastomosing; spore print slightly deeper than G, usually between G and H or reaching H (Crawshay). — Stipe white, either remaining so or becoming slightly sordid-cinereous-glassy in age, subrugulose, glabrous, equal, tapering upward or downward, or ventricose, solid, then stuffed or stuffed-hollow, 20—60 ⇌ 4—14 mm., rarely broader or longer. — Context white, unchanging, or becoming slightly sordid inside the old stipes, rather firm at first but soon becoming soft, spongy, and fragile; taste mild or rarely slightly bitter-markish; odor none.

Spores 7.8—13 ⇌ 6.4—10.3 µ, mostly 9.2—10 ⇌ 7.7—8.3 µ, orn. 0.8—1.4 µ, mostly 0.8—1 µ, of type III b and III b—II, also IV—II and fewer II, IV, more rarely type IV predominant but III b and IV—II numerous, few spores of type III a, VIII, V, or VI; basidia 30—48.5 ⇌ 9.8—13.5(16.5) µ, clavate, 4-spored; macrocystidia always blue in SV over the upper half or more (not only at the apex as in *R. nauseosa*), scattered to numerous, clavate to fusoidor ventricose, some-

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times ampullaceous, often appendiculate, subacute or rounded if not appendiculate, 32—60 ⇌ 7—12 μ; appendage e. gr. 5 μ long; on edge slightly more cystidia than on sides, also occasionally some sphero-cysts present; epicutis of pileus, among the gelatinized hyphae, with numerous dermatopseudocystidia of the macrocystidia-type, bluing strongly with SV, all with granular to mostly banded contents, not to sometimes septate, varying from rather narrow to broad and conspicuous although not so crowded as in the *Urentinae*, 40—277 ⇌ 5—8.5(12.2) μ; hypodermium consisting of a cutis of filamentous hyphae, pigment intracellular and pale purplish to beautifully amethyst purple (NH_4OH); hyphae without clamp connections.

Formalin on context of stipe, even in the old one, negative.

On the ground under conifers, most frequently under *Pinus* specc., but also under other genera in North America, in Europe mostly under *Pinus silvestris*. Fruiting in summer and fall.

Material studied: Europe: Austria, Oetztal (not preserved). — Sweden, Öland, Böda sin, Haglund & Hultén 129a, S. — Runmarö, Rydberg 45a, S. — Runmarö, Haglund and Haglund, Jahn & Rydberg, and Haglund & Rydberg, three good recent collections, S. — Solbergen, Rydberg & Haglund, S, also no. 180a, 190a, S. — Germany, J. Schäffer, Russ. Exsicc. as *R. nauseosa sine cyst. epicutis pilei*, and *R. nauseosa* f. *atropurpurea sed mitis*, FH. — England, type of *R. cessans*, Herb. Pearson. — Italy, part of type (?), and authentic material of *Russula turci* Bres. (mixed wih *R. neglecta* Sing. in the former), S. — North America, *Mich.*: Chippewa, Luce Co., Tahquamenon Falls State Park, Singer, N 779, N 863, N 864, MICH, F. — Emmet Co., Wilderness State Park, Singer, N 1067, MICH, F.

This usually small, mild species is often confused with *R. nauseosa* from which it differs in the sulfovanillin reaction of the cystidia and the perfectly mild taste. It differs from *R. allescheri* in mild taste. It is apparently sometimes called *R. lateritia* Quél. but it is highly improbable that the original *R. lateritia* is this although that of Melzer's may be. This species is *R. turci* of Singer (4) and possibly that of Peck, and partly that of Bresadola who mixed it up with *R. neglecta* and *R. punctata* (see Singer, 1). The author has proposed to abandon the much misused name *R. turci* Bres. as a nomen confusum (ambiguum). Pearson's type is exactly identical with the American collection. The species is new for America.

Subsection *Urentes* Maire.

Russula aurantiolutea Kauffm., Rep. Mich. Acad. Sc., **11**: 81. 1909.

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Pileus copper orange to lemon yellow, mostly a combination between the two colors or dusky orange with yellow portions or dots with some dull orange red shades, rarely unicolorous yellow or reddish, the yellow near "sunflower dandelion" (color of inflorescences of *Taraxacum officinale*) or „banana" to "primulin y." (M & P), the reddish near "Burma gold", strongly viscid when wet, slightly shining to subopaque when dry, glabrous, with the pellicle in young and wet caps separable two thirds to entirely, in others one to two thirds of the radius, with subacute then obtuse, then rounded margin, smooth, soon becoming long to short tuberculate sulcate on the margin (in an average over a zone 10 mm. broad), convex, soon with depressed center, then applanate, 40—130 mm. broad. — Lamellae cream color, then light ochraceous to rather deep ochraceous yellow (Crawshay no. 3—4 in side view, 11 seen collectively from above), rather broad to broad (6—10 mm.) broadest in the marginal third, simple or more often forked near the stipe, usually not strongly ventricose, crowded to subclose, usually close, equal, sometimes with few lamellulae, narrowed toward the stipe and narrowly adnexed to free, sometimes separating from the stipe and becoming remote, especially in age; spore print variable between somewhat deeper than E, and H, usually with the tone quality of E but deeper and assuming a shade somewhat deeper than E to G or even H (Crawshay). — Stipe white, glabrous, rugulose or subrugulose, solid, soon spongy and eventually hollow, subequal, usually shorter than the diameter of the pileus, 48—120 ⇌ 11—32 mm. — Context white, unchanging, sometimes somewhat yellowish underneath the cuticle, comparatively thin and fragile in the pileus when mature; taste distinctly to strongly acrid; odor none.

Spores 7.5—10.5 ⇌ 6.3—8 μ, orn. 0.7—1.2 μ, mostly around 1 μ, of type IV and VIII (III b—VIII, IV—VIII), fewer spores of type II—III b, III b, V, even occasionally VI; basidia 33.5—39 ⇌ 9.5—12.5 μ, 4-spored; macrocystidia with abundant banded contents, quite compactly blue in SV, versiform, often more or less cylindrical, numerous to very numerous, 50—70 ⇌ 7.5—11.5 μ, usually appendiculate (appendage 3—16 μ long); epicutis of pileus consisting of hyphae which are sometimes somewhat pilose at the ends, thin obtuse or attenuate above, non-incrusted, and versiform, often vermiform, ventricose-ampullaceous or clavate-subcylindric dermatopseudocystidia which are of the macrocystidia-type, bluing or blue granular in SV, the true cystidioid bosies usually in a minority, the laticiferoid (vermiform, thin 1.5—6 μ diameter) bluing bodies in the majority and usually very numerous, the true cystidioid ones obtuse at the apex, 52—111 ⇌ 5—8.2 μ; surface of stipe with the same elements as the epicutis but not gelatinized, the true cystidioid bluing bodies here more numerous in most collections.

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$FeSO_4$ on the interior of the stipe deep sordid gray, in the cortex pale reddish gray. — Phenol on context chocolate. — Formalin on context of stipe negative. — KOH on surface of pileus lemon yellow even in the reddish areas.

On the ground in frondose (*Betula, Acer, Fagus, Populus*) and mixed woods, possibly mostly with *Betula* specc., fruiting from summer until fall. In the mountains of Southern Europe rare, in North America (not reaching Florida) common.

Material studied: Spain, Ribera de Sant Maurici, July 1934, Singer, BC. — *N. Y.*: Newcomb Co., Huntington Forest near Newcomb, September 12, 1941, Singer, FH. — *Mich.*: Material from the type locality, coll. & det. C. H. Kauffman, MICH, LE, topotype, authentic. — Luce Co., Tahquamenon Falls State Park, Singer, F 760, MICH, F. — Emmet Co., Mackinaw City Hardwoods, Singer, F 572, MICH, F. — Cheboygan Co., Douglas Lake, Singer, F 637, MICH, F.

The species is not always typically tall; some medium sized groups or specimens can be encountered; aside from that, the reddish tints may be completely absent. With its occurence in Spain now established, it seams that Bresadola's determination may be correct. Although specimens have not been examined, his description and illustration may conceivably belong here. The same is true for Beardslee's account. The species probably reaches the Carolinas.

Russula macropoda Sing., Bull. Soc. Myc. Fr. **55**: 277. 1939.

Pileus "scarlet", "Goya", "redfeather" (M & P), center often yellow dotted, smooth, viscid when wet, with slightly shining cuticle which becomes dry rapidly and turns opaque on drying out, glabrous, the cuticle separable only in the marginal region, with obtuse to rounded margin, not or not distinctly sulcate on the margin, convex and mostly umbilicate, then convex-applanate with more or less depressed center, 45—75 mm. broad. — Lamellae pale ochraceous, in age deep ochraceous, narrow to moderately broad (4—7 mm.), broadest in the marginal third, equal or with very few lamellulae and or forked ones, anastomosing, close to crowded, narrowed toward the stipe and adnexed to subfree, eventually appearing subdecurrent, especially in dried material; spore print in tone quality between "antimony yellow" and "warm buff" (R.), "cavalry, deep chrome y." (M & P), between G and H (Crawshay) in shade. — Stipe white, usually slightly pale grayish when handled, subrugulose, solid, then somewhat spongy and stuffed-hollow, equal or tapering upward, usually firm and voluminous and longer than the diameter of the pileus, 50—100 ⇌ 15—25 mm. — Context white in pileus and stipe, unchanging, sometimes reddish underneath the cuticle of the pileus,

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especially in old specimens; taste mild but becoming strongly acrid after some mastication (as in *R. tenuiceps* and *R. badia*), but not bitter; odor none, or slight and indistinctive.

Spores 7—11 ⇌ 6.3—9.8 μ, usually 9—10 ⇌ 8—9 μ, orn. 0.4—1.3 μ, most frequently 0.6—1 μ, of type II—III b, IV—II, III b III b—VIII, in few occasional spores III a, II, IV, V, consisting of cylindrical spinules and warts or short crestes ridges and rather fine anastomoses between them forming only very rarely a complete network; basidia 37.5—48 ⇌ 10—11.7 μ, 4-spored; macrocystidia with abundant banded contents, bluing in SV, fusoid to clavate-ventricose or ventricose-subcylindrical, most of then appendiculate, sometimes with a short, sometimes with a long appendage (appendage 4—15 ⇌ 1—12 μ), acute or obtuse above, 54—68 ⇌ 9.8—15 μ numerous; epicutis of the pileus consisting of an ixotrichodermium of hyphae and dermatopseudocystidia, the latter of the macrocystidia-type, with abundant banded contents and bluing in SV, up to 150 μ long and 6—12.5 μ broad, very numerous; covering layer of stipe also with very numerous dermatopseudocystidia.

On the ground in mixed woods under *Populus tremula, P. tremuloides, Abies sibirica, Pinus sibirica, P. rigida,* and occasionally *Quercus* specc. solitary or gregarious, usually solitary or in small groups, fruiting in summer and early fall. Siberia and North America.

Material studied: Altai Mts., Teletskoye Ozero, Singer & Vasilieva, LE, paratype. — *Va.*: John's Creek Ridge near Blacksburg, Giles Co., Singer, V 270, FH. — *Mich.*: Type, LE, MICH.

This species differs from other ochraceous-spored bright red species of the *Urentinae* in having a variable but never isolated spinose-echinate ornamentation of the spores with numerous individual spores showing at least short ridges. Two Floridian species, one occuring under oak and extremely similar to *R. macropoda* except for more isolated echination of the spores and habitat (preserved under the herbarium name *R. praetervisa* Sing. ined. FH, no. F 2801), the other with similar although very slightly lower spore ornamentation as compared with *R. macropoda,* but paler in color, with relatively shorter stipe, pinophilous, and apparently rather rare, described by Murrill as *Russula rooseveltiana* (Lloydia **6**: 215, 1943, type seen) and again as *R. pseudofoetens* Murr. (ibid. **7**: 312, 1944, type seen and compared, has not the slightest similarity with *R. foetens*), are both extremely close to *R. macropoda* Sing. but apparently different and more thermophilous, inasmuch as they are summer-fruiting. *R. rooseveltiana* is also close to (but not identical with) *R. lundellii* Sing. and *R. mesospora* Sing., from Northern Europe and Northern Asia respectively.

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Russula diaboli Sing., Lilloa **22**: 719. 1949 (1951), nom. subnud.; spec. nov.

Pileo unicolor, laete rubro glabro vel minime subvelutino, opaco, visci dulo, 26—52 mm. lato. — Lamellis ochraceo-luteis; sporis obscure ochraceis. — Stipite roseo-rubro vel partim albo, partim roseo, 35—60 ⇌ 7—14 mm. — Carne alba, immutabili, inodora, tarde leniter vel manifeste acri. — Sporis 8—11 ⇌ 6.8—10.3 μ, plerumque cristulatis, spinulis cristulisque 0.5—1 μ altis; cystidiis typi macrocystidiorum; dermatopseudocysaidis in cuticula pilei et in stipite numerosis. — Reactionibus normalibus. — Sub quercubus, Florida, typus F 2817/I, FH.

Pileus bright red, unicolorous, glabrous to extremely slightly subvelutinous, slightly viscid when wet, drying rapildy and then opaque, with subobtuse, eventually rounded margin which is smooth, becoming sulcate when mature, convex, then with more or less depressed center, 26—52 mm. broad. — Lamellae cream color and in some collections many with pink edge near the margin of pileus, then ochraceous yellow, anastomosing, subdistant or moderately close, attenuate-subfree, broadest in the marginal third, rather broad (5 mm.); spore print H when fresh, in the herbarium becoming between G and H, or remaining H (Crawshay). — Stipe mostly entirely or over large areas rosy red, more rarely partly white, partly pink, subrugulose, glabrous, solid, then stuffed, but not hollow, subequal, or tapering either upward or downward, 35—60 ⇌ 7—14 mm. — Context white, unchanging, rather firm, then fragile and in the stipe spongy; taste either slowly and moderately acrid or soon distinctly acrid.

Spores 8—11 ⇌ 6.8—10.3 μ, mostly 9.8—10 ⇌ 8.3 μ, orn. of type II—III b and II—IV (with shorter or longer ridges and fine connecting lines which do not form a complete network), fewer spores with orn. VI—VIII (catenulate without connecting lines), IV, V, III b, projecting 0.5—1 μ; basidia 35—51 ⇌ 11—14.2 μ, mostly 37—38 ⇌ 12—12.5 μ, 4-spored; macrocystidia with abundant banded contents, yellow, bluing in SV, 45—70 ⇌ 9—17 μ, mostly 70 ⇌ 9—12 μ, with 5—11.5 μ long appendage, versiform, numerous; edge of lamellae slightly subheteromorphous (more macrocystidia there than on the sides of the lamellae); subhymenium rather narrow (about 36 μ broad), subcellular; hymenophoral trama vesiculose; epicutis of pileus formed by an ixotrichodermium of filamentous hyphae which often appear characteristically attenuate at their apex (below apex about 3.3 μ broad, at apex 1.6 μ), oleiferous hyphae, and dermatopseudocystidia, the latter typical and numerous, of the macrocystidia-type, with granular to banded contents; hypodermium consisting of

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a cutis of dense filamentous hyphae with dissolved intracellular pink pigment (NH_4OH).

$FeSO_4$ with context of stipe sordid gray. — Phenol with context chocolate. — Metol positiv, reaction fairly strong.

On humus and sandy soil under *Quercus,* rare, fruiting in summer, North Florida.

Material studied: Alachua Co., Planera Hammock, July 21, 1943, F 2877, FH, paratype. — Devil's Millhopper Hammock, July 1943, Singer, F 2817/I, FH, holotype.

Survey of the Species treated.

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