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Russula section *Xerampelinae* in Texas

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Abstract – *Russula texensis sp. nov.* is described from Newton Co, Texas, as a new typical member of sect. *Xerampelinae*. It is a very rare species that can be defined by the combination of characters of spores and those of hyphal terminations and dermatocystidia in the pileus.

INTRODUCTION

Russula section *Xerampelinae* (Singer) Jul. Schaeff. is one of the most complex species-groups in the genus *Russula*. The members of this section are also commonly called 'fishy russulas' because of the typical fishy to crab-like smell that develops with age. Although very easily characterized as a group by the greenish reaction of the context to iron sulfate (usually applied to the stipe surface), the distinction of individual species has been causing headaches to every single Russula expert who tried to define taxa within this section. In Europe, very divergent views are held by splitters (e.g. Carteret & Reumaux, 2005, 2006) stressing even the slightest macroscopic color change in defining new taxa, and lumpers (e.g. Keizer & Arnolds, 1995; Adamčík, 2004) who ignore most macroscopic color variation in favor of microscopic features. The majority of mycologists (e.g. Kärcher, 2000; Sarnari, 2006), however, closely adhere to the concepts introduced by Romagnesi (1967).

Remarkably enough, tropical habitats (perhaps even the entire southern hemisphere?) seem to have been spared from this taxonomical nightmare. There are no reports of fishy russulas from neotropical lowlands (Singer *et al.*, 1983), nor has any member of *Xerampelinae* been found after many years of collecting in Madagascar (Buyck, unpubl.). And more than a century of mycological inventory in tropical Africa has revealed only a single, rather atypical member of *Xerampelinae*: *Russula oinochroa* Buyck, based on a single individual (Buyck, 1994) and still only known from the type. It may, therefore, not be surprising that fishy russulas have also rarely been collected in the southeastern US although several species are certainly present there (D. Mitchell, pers. com.). In fact, the only known southern *Xerampelinae* are some of the species described by Murrill

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(1940, 1943, 1945) from Florida but their affiliation to this section was only established many years later by Singer (1958) who synonymized these taxa with *Russula xerampelina* var. *semirubra* Singer.

As far as the State of Texas is concerned, the occurrence of fishy russulas can clearly be considered to be exceptional. Thiers (1956) collected 14 *Russula* species for the state, but did not find any member of the *R. xerampelina* group. Nor has one of us (D.P.Lewis) ever seen sect. *Xerampelinae* – apart from the present taxon – in Texas, and this notwithstanding 35 years of continuous collecting in the state. The only (unpublished) record of *R. xerampelina* (to be taken sensu lato) is by Castro-Mendoza (1978) from the central mineral region of Texas. This region is an area where Precambrian rocks may be found on the surface and the soils are primarily derived from granite. The dominant woody trees are Scrub Live Oak (*Quercus fusiformis*) and other *Quercus* species, Mesquite (*Prosopis glandulosa*) and Ashe Juniper (*Juniperus ashei*).

MATERIALS AND METHODS

Micromorphological characters were observed in Olympus CX-41 and Nikon Eclipse E400 microscopes using an oil-immersion lens at a magnification of 1000x. All drawings of microscopical structures – except of spores – were made with 'camera lucida' using a Nikon Y-IDT drawing attachment at a projection scale of × 2400. Contents of hymenial cystidia and pileocystidia in the illustrations are indicated schematically, except for a single element where contents are indicated as observed in Congo Red preparations from dried material. Spores on the lamellae were observed in Melzer's reagent. All other microscopic observations and made in ammoniacal Congo red, after a short aqueous KOH pre-treatment to improve tissue dissociation and matrix dissolution. All tissues were also examined for the presence of ortho- or metachromatic contents or incrustations in cresyl blue as explained in Buyck (1989).

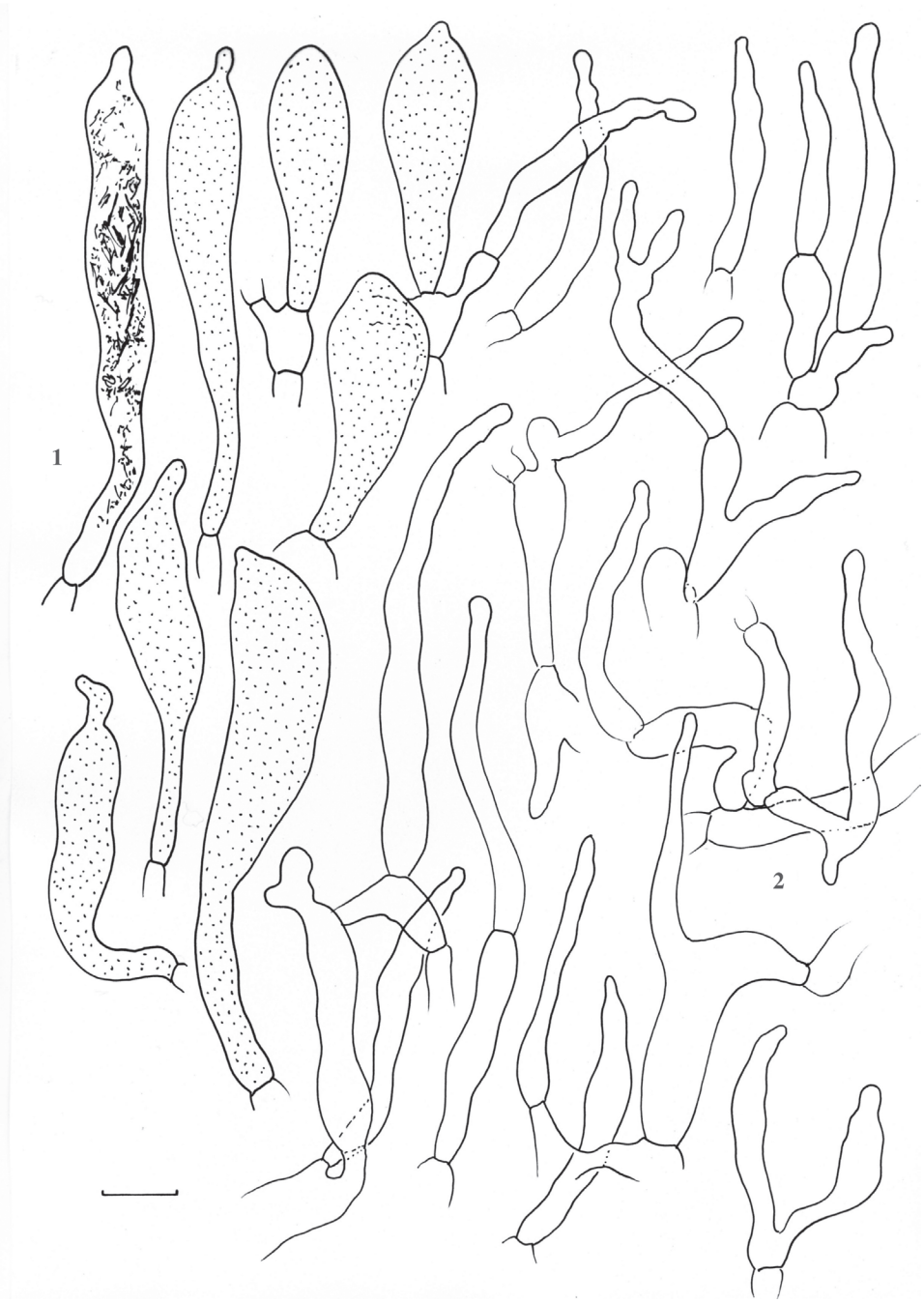
Spores were scanned with an Olympus Artcam camera and measured using Quick Micro Photo (version 2.1) software. Enlarged scanned pictures of spores were used for measuring with an accuracy of 0.1 µm and for drawing. Q gives length/width ratio of the spores. Measurements exclude ornamentation. Statistics for measurements of microscopical characters are given as mean value (underligned) plus/minus standard deviation and are based on 30 measurements. Values in parentheses give measured minimum or maximum values. An estimation for spore ornamentation density is given following Adamčík (2000).

DESCRIPTION

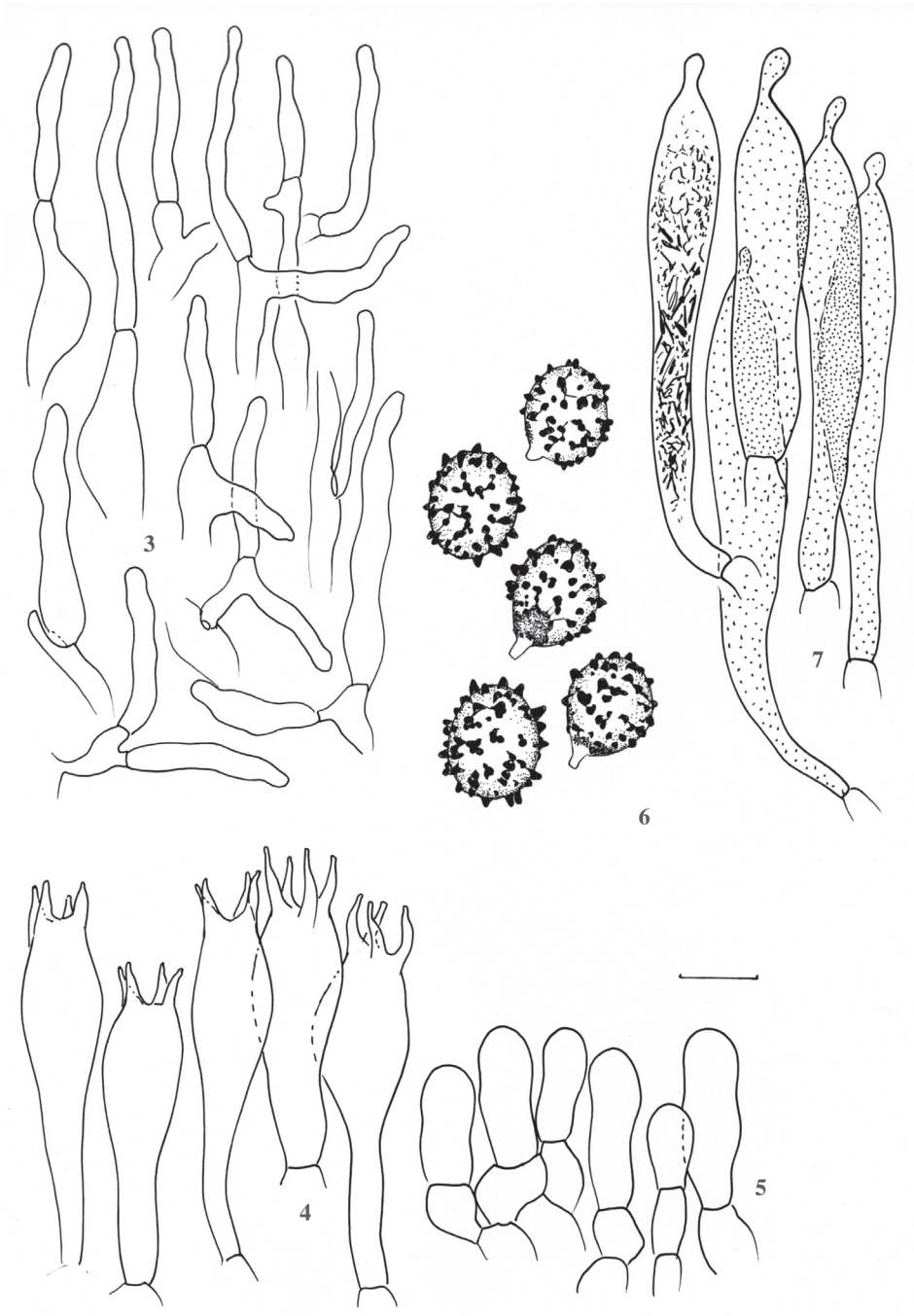
Russula texensis *sp. nov.*

Latin diagnosis

Pileus *73 mm diam., haud zonatus, regularis, marginem versus laevis dein breviter striatus, pileipellis partim secernens, glaber, vinaceus, fere purpureus in centro, irregulariter pallidiore marginem versus*



Figs. 1-2. *Russula texensis* (holotype). **1.** Pileocystidia, with contents indicated in one element as seen in Congo red. **2.** Hyphal terminations near margin of pileus. Scale bar = 10 μm.



Figs. 3-7. *Russula texensis* (holotype). **3.** Hyphal terminations in pileus centre. **4.** Basidia. **5.** Basidiola. **6.** Spores in Melzer's reagent. **7.** Hymenial cystidia with contents indicated in one element as seen in Congo red. Scale bar = 5 µm for spores, 10 µm for the other elements.

Fig. 8 *Russula texensis* (holotype). Field aspect (Photo B. Buyck).

Fig. 9. *Russula texensis* (holotype). Macroscopic aspect of gills and stipe (Photo B. Buyck).

Stipes *cylindratus, 56 × 14-16 mm, glaber, haud pruinosus, albus sed mox sursum fulvescens, intus spongiosus.* ***Caro*** *albida, intus mox brunnescens vel grisescens, griseoviridis ope $FeSO_4$, mitis, odor ingratus.* ***Lamellae*** *friabiles, adnatae vel sublibrae, haud confertae, albidae ad cremeae, lamellulae nullae, acies integra, concolor.* ***Sporae*** *pallidae in cumulo.*

Sporae *breviter ellipsoideae, (6,4-)6,9-7,3-7,8(-8,3) × (5,3-)5,6-6,2-6,6(-6,7) µm, Q=(1,07-)1,12-1,19-1,26(-1,32), ornamentatione valde amyloidea, spinis moderate densis, 0,4-0,9 mm altis, locale connectis vel confluentibus ornatae.* ***Basidia*** *(34-)39-43,9-49(-57) × (10-)10,5-11,3-12(-13) µm, tetraspora, clavulata, macula suprahilaris amyloidea.* ***Pleurocystidia*** *haud numerosa (< 500/mm^2), 49-64,7-83 × 7-9,2-11,5 µm, clavata vel fusiformia, pedicellata, mucronata ad capitulate, tenuitunicata vel paulum medio incrassata, contentu fibrillosa SV insensibile repleta.* ***Pileipellis*** *omnino orthochromatica in azureo cresylico, hyphis intertextis paulum gelatinosis composite; suprapellis 40-50 _m crassa, pilis ascendentibus, attenuatis tenuitunicatis efformata; cellula terminale marginem versus (25,5-)31,5-39,6-48(-66) × (3,5-)4-4,7-6(-7) µm, centro minus crassa et (16-)18-24,2-30(-40) ×2,5-3,3-4(5,5) µm, attenuata, apicale constricta vel moniliforme modo constricta, interdum diverticulata. Pileocystidia distincta abundantiaque in pilei superficie, unicellulata, 32-52,7-73 × 8-11,1-14 µm, fusiformia vel clavata, pedicellata, generaliter mucronata vel appendiculata, rara et longioria in subpelle, contentu fibrillosa SV insensibile repleta.* ***Fibulae*** *nullae.*

Holotypus: USA: Texas. Newton Co., Bleakwood, D. Lewis' property, in mixed bottomlands with water oak, laurel oak, beech (*Fagus grandifolia*), loblolly pine and swamp chestnut, 24 July 2007, Buyck 07.070 (PC, holotypus)

Cap 73 mm diam., not zonate, regular, smooth near margin, then shortly striate for 5-7 mm, surface peeling to mid-radius, glabrous, dull, pinkish red to vinaceous, almost dark reddish purple in the center but towards the margin quickly developing a marbled aspect with paler (discolored ?) and darker patches alternating in a more or less radial pattern. **Gills** brittle, shortly adnate to subfree, equal, with local anastomoses near stipe attachment, rather spaced, slightly less than 1/mm, whitish to cream coloured, with anastomosing veins in dorsal part; gill edge even, concolorous. **Stipe** central, cylindrical, 56 x 14-16 mm, shorter than cap diam., smooth and with satin like brillance, not pruinose, white but developing dirty stains from handling, without cavities, but spongy-soft inside. **Context** white, quickly graying-browning inside stipe, turning greenish grey with iron sulfate on stipe surface as well as on context. **Taste** mild. **Smell** typical but weak, fishy. **Spore print** insufficient for precise appreciation, but evidently quite pale.

Spores shortly ellipsoid, (6.4-)6.9-7.3-7.8(-8.3) × (5.3-)5.6-6.2-6.6(-6.7) µm, Q=(1.07-)1.12-1.19-1.26(-1.32), ornamentation of relatively distant spines with (3-)4-6(-7) spines in a 3 µm circle; spines conical, amyloid, 0.4-0.9 µm high, occasionally connected (0-2 line connection in a 3 _m circle) or locally fused in short chains (0-3 fusions in same circle), few isolated; suprahilar spot distinct, amyloid. **Basidia** (34-)39-43.9-49(-57) × (10-)10.5-11.3-12(-13) µm, 4-spored, clavate-pedicellate; basidiola first cylindrical or subclavate, then distinctly inflating apically. **Subhymenium** pseudoparenchymatic. **Lamellar trama** mainly composed of large sphaerocytes. **Hymenial cystidia** less than 500/mm^2, measuring 49-64.7-83 × 7-9.2-11.5 µm on sides, shorter and rare on gill edge, clavate to fusiform-pedicellate, mucronate to capitulate, thin-walled or with slightly thickened wall in the central part; contents abundant, granular-crystalline and hardly reacting to sulfoaldehydes. **Pileipellis** orthochromatic in cresyl blue, not sharply delimited from the underlying spherocytes of the context, thin, vaguely divided in a dense, rather poorly gelatinized, 40-50 µm deep subpellis and a less

dense 40-50 µm deep suprapellis of ascending hyphae, composed of distinct pileocystidia and endings of generative hyphae. Hyphal endings thin-walled, near margin with terminal cells measuring (25.5-)31.5-39.6-48(-66) × (3.5-)4-4.7-6 (-7) µm, subcylindrical or slightly tapering towards the apex, more or less sinuate and mostly subapically- and sometimes repeatedly- constricted, occasionally with short lateral branches or diverticulate ; subapical cells usually more irregular, often locally inflated, 4-8 µm diam., some branched ; hyphal endings in the centre of pileus similar, but less irregular and less voluminous compared to those near the margin, (16-)18-24.2-30(-40) × 2.5-3.3-4(5.5) µm. Pileocystidia very distinct and abundant near surface, one-celled, 32-52.7-73 × 8-11.1-14 µm, fusiform or clavate, mostly pedicellate, often mucronate or shortly appendiculate, in subpellis rare and much longer, with granular to needle-like contents that hardly react to sulphovanillin. **Clamp connections** absent in all parts.

Specimen examined – USA: Texas. Newton Co., Bleakwood, D. Lewis' property, in mixed bottomlands with Water Oak (*Quercus nigra*), Laurel Oak (*Quercus laurifolia*), Swamp Chestnut Oak (*Quercus michauxii*), White Oak (*Quercus alba*) and Hickory (*Carya* species) as dominant species and Beech (*Fagus grandifolia*), and Loblolly Pine (*Pinus taeda*) on slightly higher ground ("hammocks"), 24 July 2007, Buyck 07.070 (PC, holotypus)

DISCUSSION

Our description is unfortunately based on a single collection composed of only one, well-preserved fruit body.

Russula texensis is by all means a typical member of sect. *Xerampelinae* because of the features of its context: a grayish-green reaction to $FeSO_4$, development of brownish-greyish tinges with age or on bruising, and the fishy smell. By its overall colours, the species macroscopically reminds of the common European *R. graveolens*, which is typically associated with *Quercus* but grows also with other deciduous trees such as *Carpinus*, *Castanea* or *Tilia*.

Under the microscope, the characters of pileocystidia (one-celled, typical shape), hyphal terminations in the pileipellis (size, irregular shape, less voluminous in center than on margin) and spores (relatively small, spiny) allow further characterization of this species. No other known representative of *Xerampelinae* in USA has this combination of characters, nor have any of the possible look-alikes among Murrill's russulas (Adamčík & Buyck, in prep.).

A character which is more subjective or difficult in its appreciation concerns the terminal cells of the generative hyphae being distinctly sparser close to the cap margin compared to other members of *Xerampelinae* and showing here and there surfacing lateral branches of subapical cells. The importance which is here given to size and shape of hyphal terminations (esp. the terminal cell) seems to be supported by preliminary phylogenetic analyses of ITS sequences of some European *Xerampelinae* (Eberhardt & Adamčík 2007). Indeed, European species with inflated terminal cells in the centre of the pileipellis form a separate clade from taxa with less voluminous terminal cells in the cap centre. If this character were to be corroborated also elsewhere, then we can expect that *R. texensis* is indeed closely related to *R. graveolens*.

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