

(< 100 μm long), which do not taper toward the base (e.g. Migliozi and Coccia 1989).

Leucoagaricus brunnescens (Peck) Bon in the interpretations of Bon (1993) and Migliozi and Perrone (1992) comes very close to *La. decipiens*. The collection studied by Migliozi and Perrone (1992) differs because of the longer spores (< 8 μm) and pileus surface hyphae with obtuse and short (< 150–200 μm) terminal elements. Bon (1993) described the lamellae as “subcollariées”, a character also observed in *La. decipiens* and *La. erythrophaeus*. Bon (1993) also stated that the cheilocystidia could be incrusted. Bon (1981) studied the type collection of *L. brunnescens* Peck, but except for commenting that it is close to *La. jubilaei* but differs in the simple cylindrical cells on the pileus he did not list its characters. *Leucocoprinus brunnescens* (Peck) Pegler *sensu* Pegler (1983) is a different species altogether, characterized by the narrowly lageniform to broadly appendiculate cheilocystidia, spores with a faint germ pore and a pileus covering composed of repent hyphae with short terminal elements, 35–80 μm long.

Leucoagaricus pseudopilatianus Migl., Rocabruna & Tabarés is a much more robust species, with clavate cheilocystidia, spores with a distinct apical papilla and pileus covering elements with rounded blunt apices; the dried material, including the lamellae, is dark to almost black (Migliozi et al. 2001).

Finally, *Lepiota roseolivida* Murrill (in Europe better known as *La. marriagei* [D.A. Reid] Bon) is a slender fragile species with a pink-lilac pileus covering, composed of repent hyphae (Vellinga 2006, Migliozi and Perrone 1991). It does not turn black on drying, although it can turn green when exposed to ammonia.

***Leucoagaricus erythrophaeus* Vellinga, sp. nov.**

FIGS 3, 4

Mycobank MB 513552

Misapplied name. *Lepiota roseifolia sensu* Arora, Mushr. Demystif., Ed. 2:305. 1986; *sensu* Sundberg, Fam. *Lepiotaceae* California: 115–119. 1967.

TYPE. UNITED STATES OF AMERICA. California, Humboldt County, Arcata, Community Forest, 9 Nov 2004, *E.C. Vellinga 3243* (UC).

Etymology. Erythrophaeus is derived from two Greek words: ερυθρος, red, bloody, and φαιος, dark, because of the bright red reaction and the subsequent change into dark colors.

Pileus 18–60 mm, in juventute hemisphaericus cum margine inflexo deinde convexus, postremo plano-convexus vel leviter plano-concavus, ad medium integrus et griseo-velutinus, obscure rubro-purpureus vel obscure nigro-brunneus, aliunde in squamulis fibrillosis obscure

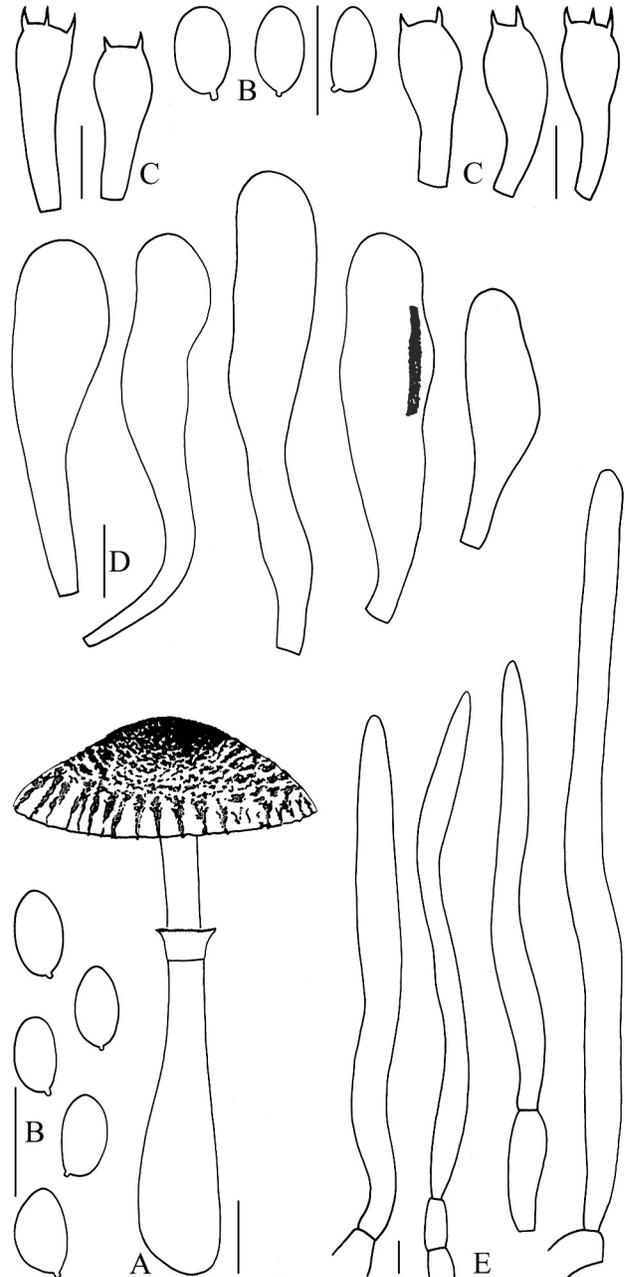


FIG. 3. *Leucoagaricus erythrophaeus*. A. basidiocarp; B. spores; C. basidia; D. cheilocystidia; E. elements of the pileus covering (all from holotype, ecv3243); brown contents of cystidia and pileus covering elements are not indicated. Bars = 1 cm (basidiocarp) and 10 μm (microscopical characters).

rubro-purpureis vel obscure nigro-brunneis in contexto albo excoriatus, tactu statim rubro-aurantius sed ad brunneum vergens. Lamellae sat confertae vel confertae, liberae, distantes, saepe collariatae, albo-flavidae, tactu rubescentes, acie cystidiosa, alba, tactu brunnescente obtectae. Stipes 55–70 \times 4–5 mm, cylindricus sed versus basim, in tertio inferiore, clavatus, albus, tactu primo rubro-aurantius dein nigrescens atque obscurus; annulo adscendente, simplice,

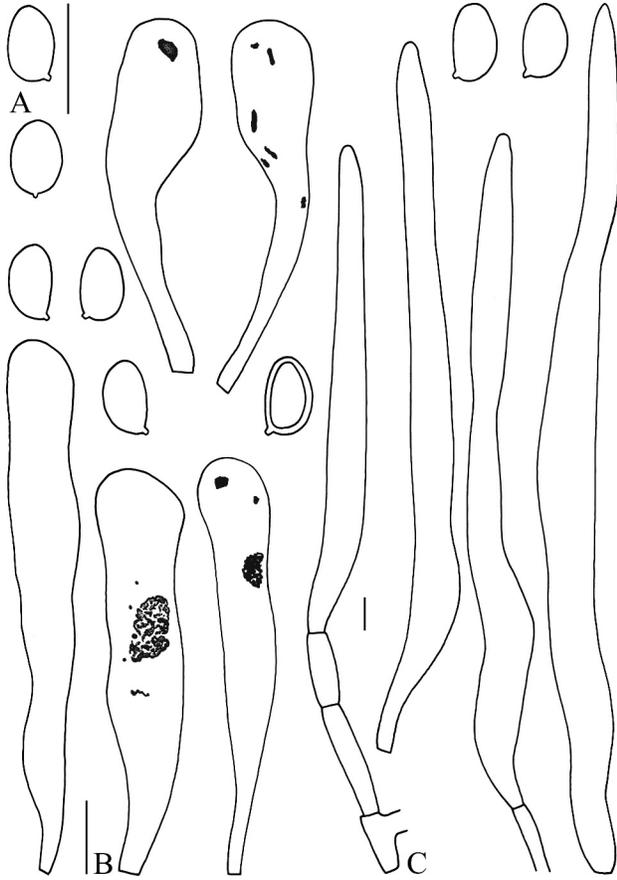


FIG. 4. *Leucoagaricus erythropaeus*. A. spores; B. cheilocystidia; C. elements of the pileus covering (all from ecv3254); brown contents of cystidia and pileus covering elements are not indicated. Bars = 10 µm.

fimbriato, albo margine tactu brunnescente oblecto. Caro in pileo alba vel albida sed fracta leviter et fugaciter aurantians, in stipite pallide cremeo-albida vel flavida, fracta aurantians. Odor haud peculiaris, adstringens vel lepiotoides.

Basidiosporae $5.9\text{--}8.8 \times 3.5\text{--}4.9$ µm, ellipsoideae vel ellipsoideo-amygdaliformes, aliquae oblongae et leviter amygdaliformes, dextrinoideae. Pleurocystidia nulla. Cheilocystidia $30\text{--}75 \times 8.0\text{--}14.0$ µm, strictiter clavata, strictiter utriformia usque ad irregulariter cylindracea et pedicellata, succo brunneo atque granulis in ammonia brunnescentibus impleta. Operimentum pilei ad medium trichodermicum, versus marginem in cute sed cum aliquis hyphis ascendentibus formatum, ex hyphis elongatis usque ad 350×20 µm formatum; apices hyphae fusoides vel saepe etiam rotundatis vel capitatis; hyphae pariete brunnea ad basim oblectae, saepe etiam granulis brunneis vel succo brunneo impletis. Fibulae absentes.

Leucoagarici decipienti similis, sed in spatii interne transcripti sequentia ("ITS").

Pileus 18–60 mm, when young hemispherical with inflexed margin, expanding via convex or widely conical to finally wavy plano-convex to slightly plano-

concave, at center covered, velvety-plushy gray, dark purplish-reddish, to dark brown-black, around center breaking open into concentrically arranged small fibrillose grayish brownish to dark brown-black squamules, often in bands, on white background, when touched immediately red-orange, changing to dark brown; margin irregular in young specimens, later evening out, exceeding lamellae. *Lamellae* free and remote from stipe, often attached to a kind of collarium, moderately crowded to crowded, ventricose, yellowish white, with white cystidiose edge, orange when touched, at least on edge, and edge darkening after being touched. *Stipe* $55\text{--}70 \times 4\text{--}5$ mm, cylindrical in upper two-thirds and widening downward to up to 15 mm wide base, pale at apex and in untouched specimens pale over complete length, when touched first orange-red, changing to very dark to black, cystidiose or hairy-cobwebby over whole length, protruding into pileus, hollow. *Annulus* an ascending or descending, small, white cuff, with a flaring part with fringed edge, turning dark on edge with age and touching. *Context* white to whitish in pileus, orange where cut but soon vanishing, pale cream to yellowish in stipe, and orange where cut. *Odor* indistinct, astringent or lepiotoid. *Taste* unknown.

Basidiospores [273,14,12] in side view $5.9\text{--}8.8 \times 3.5\text{--}4.9$ µm, $avl \times avw = 6.2\text{--}7.4 \times 3.8\text{--}4.2$ µm, $Q = 1.4\text{--}2.15$, $avQ = 1.61\text{--}1.78$, ellipsoid to amygdaloid-ellipsoid, some oblong and slightly amygdaloid, in frontal view ellipsoid, relatively thick-walled, often with one guttule, without germ pore, congophilous, metachromatic in Cresyl blue, dextrinoid. *Basidia* $15\text{--}29 \times 6.5\text{--}9.0$ µm, narrowly clavate, with 4 sterigmata. *Pleurocystidia* absent. *Lamella edge* sterile, with a continuous broad band or tufts of cheilocystidia with brown contents (in ammonia). *Cheilocystidia* $30\text{--}93 \times 8.0\text{--}14.0$ µm, narrowly clavate, narrowly utriform, to irregularly cylindrical and narrowed into an often long pedicel, some with bifid apex, with brownish contents and some dark granules in ammonia. *Pileus covering* a trichoderm, toward margin more cutis-like with differentiated terminal elements; terminal elements $96\text{--}350 \times 9.0\text{--}20$ µm, most often tapering toward apex, sometimes with blunt and rounded apex, in some specimens with many shorter elements, in others only with those long elements; elements brown-walled at least in lower part, sometimes also with granulate or diffuse brown contents (in ammonia); repent connecting hyphae with dark granulate contents (in ammonia), sometimes also with parietal and incrusting pigments. *Clamp connections* absent from all tissues.

Habitat and distribution. In small groups, terrestrial, in different forests (e.g. in northern California mixed

Picea sitchensis and *Tsuga heterophylla* forests or *Alnus rubra* and *Sequoia sempervirens* and in central coastal California *Pseudotsuga menziesii* with *Sequoia sempervirens* and various other tree species) end of October through beginning of December, throughout coastal California from Mendocino County northward and in the foothills of the central Sierra Nevada. Actual distribution poorly known.

Collections examined. UNITED STATES OF AMERICA. California, Humboldt County, Arcata, Community Forest, 9 Nov 2004, *E.C. Vellinga* 3243 (nrITS GQ258469; EF1- α GQ258483; Holotype, UC); Patrick's Point SP, 23 Oct 2003, *E.C. Vellinga* 3081, 3082 (nrITS GQ258471) and 3083; *ibidem*, 9 Nov 2004, *E.C. Vellinga* 3248 (nrITS GQ258470; EF1- α GQ258482) and 3254 (nrITS GQ203805); Orrick, along Davidson Road, 27 Oct 2007, *N. Nguyen* NN02 (nrITS GQ258468; EF1- α GQ258480); Marin County, near Alpine Lake, 15 Nov 2005, *E.C. Vellinga* 3376 (nrITS GQ258472) and 3379; Mendocino County, Jackson State Demonstration Forest, 17 Nov 2001, *E.C. Vellinga* 2691 (nrITS AY243644); San Mateo County, San Mateo County Memorial Park, 4 Nov 2004, *E.C. Vellinga* 3217; Yuba County, Tahoe NF, Hornswoggle Campground near Bullards Bar, 9 Nov 2005, *E.C. Vellinga* 3358; south of Challenge, along Oregon Hill Road, 10 Nov 2005, *E.C. Vellinga* 3362.

Comments.—The species herein described as *La. erythrophaeus* has been known as *L. roseifolia* Murrill (e.g. Arora 1986, Sundberg 1967, Wood and Stevens 1996–2009). This taxon was interpreted as a species resembling *L. flammeincta* Kauffman but with lamellae that turn red when damaged and with age. However *L. flammeincta* has lamellae that do not turn red when damaged, despite a vivid and immediate reddening reaction of the stipe and pileus when touched. The type collection of *L. roseifolia* (collection Murrill 1287 [NY]) was studied (FIG. 5) and was found to differ from *La. erythrophaeus*.

Murrill (1912) described *L. roseifolia* as, "Pileus regular, convex to subexpanded, solitary, 4 cm. broad; surface dry, shining, innate-fibrillose, radiate-rimose, smooth and glabrous at the center, castaneous, blackish-tinted when fresh, assuming a more reddish tint after picking; lamellae free, crowded, slightly ventricose, regular, white when fresh, changing to rose-colored on drying or when bruised; spores ellipsoid, smooth, hyaline, $7\text{--}8 \times 3\text{--}3.5 \mu$; stipe equal, compressed, very long because buried in leaves, hollow, smooth, glabrous, avellaneous-isabelline, white at the apex, 17 cm. long, 5 mm. thick; annulus superior, slight, fixed, fuliginous."

Analysis of holotype specimen (FIG. 5).—*Basidiospores* [22,1,1] in side view $6.9\text{--}8.3 \times 3.9\text{--}4.9 \mu$, $avl \times avw$

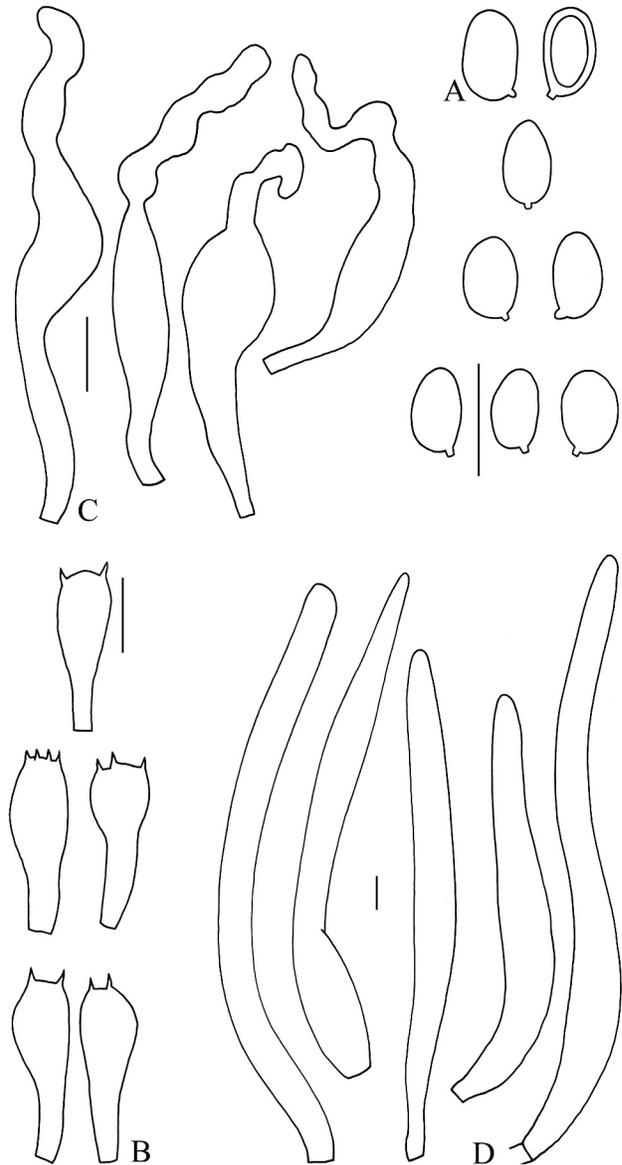


FIG. 5. *Lepiota roseifolia*. A. spores; B. basidia; C. cheilocystidia; D. elements of the pileus covering (all from holotype, Murrill 1287). Bars = 10 μ m.

= $7.5 \times 4.4 \mu$ m, $Q = 1.52\text{--}1.88$, $avQ = 1.7$, ellipsoid to oblong with rounded apex, rarely with pointed apex and amygdaliform, with flattened adaxial side, in frontal view obovoid-ellipsoid, thick-walled, congophilous, dextrinoid, metachromatic in Cresyl blue. *Basidia* $20\text{--}24 \times 7.0\text{--}8.5 \mu$ m, 4-spored. *Pleurocystidia* not observed. *Lamella edge* sterile; *cheilocystidia* $38\text{--}66 \times 6.0\text{--}12 \mu$ m, narrowly clavate to fusiform with in most cases a long moniliform excrescence (included in length of cheilocystidia), rarely only capitulate. *Pileus covering* with clusters of upright slightly differentiated terminal elements, $80\text{--}170 \times 12\text{--}19 \mu$ m, brown-walled and with rounded to tapering apex, arising from a cutis made up of cylindrical

brown-walled hyphae. *Clamp connections* not observed. Smith (1966) also studied the type collections of *L. roseifolia*, and our observations are very similar, although she reported longer spores (“8–11 × 3.6–4.5 μm, usually 8–9.5 μm long”).

However there are striking differences from the modern interpretation of *L. roseifolia* in the shape of the cheilocystidia and the fact that the lamellae of the type collection are not dark. The appendiculate cheilocystidia in the type collection of *L. roseifolia* are similar to those in *L. fuliginescens* Murrill, a species close to the European species *La. badhamii* (Berk. & Broome) Singer. The pale lamellae in the type collection of *L. roseifolia* precludes *L. roseifolia* and *L. fuliginescens* from being synonymized. The type collections of *L. roseifolia* and *L. fuliginescens* were collected on the same day in a *Sequoia sempervirens* forest near La Honda in the Santa Cruz Mountains, south of San Francisco (Murrill 1912). It often is not possible to identify the species in section *Piloselli* in the field because old specimens in particular look very much alike. In California the species often grow in the same habitat and fruit at the same time.

Lepiota roseifolia in the original sense has not yet been rediscovered in the Californian *Sequoia sempervirens* forests, hence we can only speculate about its position.

Leucoagaricus erythrophaeus is quite variable, in macroscopical and microscopical characters, especially spore size, shape and pigmentation of the pileus-covering elements vary considerably from one collection to the other. It is hard to tell *La. decipiens* and *La. erythrophaeus* apart, although the nrITS and EF1- α sequences clearly distinguish them.

Lepiota flammeatincta differs in the absence of a reddening reaction of the lamellae that are not attached to a collarium, a slender habit, relatively pale (pink or pink-gray) lamellae when dried, and a cutis-like pileus covering made up of repent hyphae.

Several still undescribed species are included (FIG. 1); these differ from the species described here either in the shape of the cheilocystidia or in the structure of the pileus covering. All California species in this group will be treated in a separate paper.

ACKNOWLEDGMENTS

The curator of NY is thanked for sending the type collection of *L. roseifolia* on loan. Remarks by two anonymous reviewers improved the present study. John Lennie made very helpful suggestions regarding presentation, and financial support by NSF grant DEB 0618293 for ECV is gratefully acknowledged.

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