

Lepiotaceous fungi in California, U.S.A. – 3. Pink and lilac species in *Leucoagaricus* sect. *Piloselli*

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Abstract – Type collections of two beautiful pink and lilac agarics, viz. *Lepiota roseolivida* and *L. decorata*, are studied, and descriptions based on many fresh collections from California are given. *Leucoagaricus marriagei* is considered a synonym of *L. roseolivida*, based on morphology and ITS sequences, and *Leucoagaricus idae-fragum* is placed in synonymy with *L. decorata*. Based on morphology and molecular data, these species belong to the *Leucoagaricus/Leucocoprinus* clade in the *Agaricaceae*. Morphologically, they are placed in *Leucoagaricus* sect. *Piloselli*. However, nomenclatural changes are not made at this moment, as there are uncertainties over generic circumscriptions within the clade.

Key words – biodiversity

Introduction

California is rich in species in the *Leucoagaricus/Leucocoprinus* clade of the *Agaricaceae* (Vellinga 2004a, b), many of which are new to science. Murrill on his 1911 trip to the west coast of North America (Murrill 1912) collected and later described several new species, of which *Lepiota roseolivida* from Muir Woods, north of San Francisco, is the most beautiful. *Lepiota decorata* (Zeller 1922, 1929) is also a striking species, originally described as *L. pulcherrima*, from central western Oregon, which is also found in California.

Descriptions of the microscopical details of the type collections, and full descriptions based on recent collections are given here.

Based on the morphological characters of these species, both belong to *Leucoagaricus* sect. *Piloselli* (Kühner) Singer, a group of species whose basidiocarps turn red, when they are scratched, and parts turn green in ammonia vapours (see also Vellinga 2004b for phylogenetic placement based on nrITS and nrLSU sequences). The taxonomy of the *Leucoagaricus/Leucocoprinus* clade in the *Agaricaceae* is still in flux (Vellinga 2004b), with the main question whether it is one genus, *Leucocoprinus* Pat., or whether it can be split up into several

smaller morphologically well-defined genera. Awaiting further research on tropical species, and the outcome of multigene phylogenetic analyses, *Lepiota roseolivida* and *L. decorata* are provisionally retained in the genus *Lepiota*, despite the fact that both species clearly do not belong there.

Methods

Standard methods for describing the basidiocarps were applied, using the terminology of Vellinga (2001). Colour annotations in the macroscopical descriptions are from Kornerup & Wanscher (1974) and Munsell soil color charts (1975). The notation [105, 7, 7] indicates that measurements were made on 105 spores in seven samples in seven collections. The following abbreviations are used: L for lamellae, l for lamellulae, avl for average length, avw for average width, Q for quotient of length and width and avQ for average quotient. The abbreviation *L.* is used for '*Lepiota*' and *La.* for '*Leucoagaricus*'. The modern descriptions are based on North American collections, though the European material which has been used as comparison, is listed for completeness.

Taxonomic descriptions

1. *Lepiota roseolivida* Murrill

Figures 1-2

Lepiota roseolivida Murrill, Mycologia 4: 234. 1912.

Lepiota marriagei D.A. Reid, Nova Hedwigia 11, Suppl.: 20. 1966 (Fung. rar. ic. Col. 1);

Leucoagaricus marriagei (D.A. Reid) Bon, Doc. mycol. 6 (24): 44. 1976.

Leucoagaricus marriagei var. *ammovirescens* Bon, Doc. mycol. 22 (88): 31. 1993.

Description of type collection (W.A. Murrill 1138 (NY)) (Fig. 1)

Murrill (1912): "Pileus convex to expanded, thin, umbonate, gregarious, 2.5-4 cm. broad; surface dry, minutely and densely fibrillose-scaly, rose-lilac, livid in the center, becoming slightly darker on drying; lamellae white, unchanging, free, crowded, narrow; spores ellipsoid smooth, hyaline, 8-9 x 4-5 μ ; stipe slender, tapering upward, subglabrous, white or pallid, changing to lilac on drying, hollow, 7-10 cm. long, 2-5 mm. thick; annulus superior, movable, ample, membranous, lilac-tinted, becoming lilac on drying."

Type study

Basidiospores [20,1,1] in side view 7.1-9.6 x 3.9-4.9 μ m, on average 8.0 x 4.5 μ m, Q = 1.6-2.0, av Q = 1.77, oblong, many asymmetrical and amygdaliform, in frontal view oblong, thick-walled, colourless, dextrinoid, congophilous and metachromatic in Cresyl Blue. **Basidia** 19-23 x 7-8 μ m, 4-spored. Lamella edge sterile; **cheilocystidia** 25-48 x 7-12 μ m, narrowly utriform, narrowly clavate, narrowly ellipsoid-fusiform, to cylindrical with narrow pedicel, colourless, slightly thick-walled. **Pleurocystidia** absent. **Pileus covering** a cutis made up of repent hyphae, with terminal elements 60-190 x 8-12 μ m, tapering towards apex; up to three to five elements in a row with intracellular brownish pigment; pileus covering exuding greenish pigment in 10 % ammonia. **Clamp connections** absent.

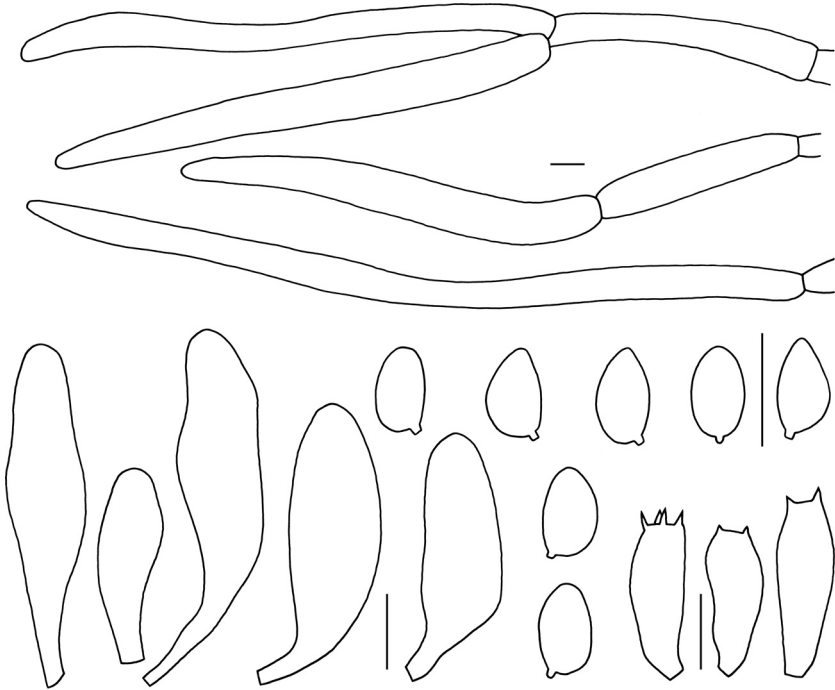


Fig. 1: *Lepiota roseolivida* – Spores, basidia, cheilocystidia and elements of pileus covering (all from holotype). Scale bar 10 μ m.

Description of modern material (Fig. 2)

Pileus 5-30 mm, widely conical, convex to plano-convex or wavy plano-convex with rounded to inconspicuous and low umbo, with age plano-concave to concave without umbo, when young with margin exceeding and overhanging lamellae, but with age equal, at centre (umbo) velvety-tomentose to slightly tufted-tomentose and around centre with radially arranged appressed short fibrils in narrow to cobwebby squamules, not or hardly showing underlying context, at margin often in v-shaped patches on white background, at centre beautiful lilac-purple (10E4), dark violet-pink (12DE5), pink-lilac (11-12CDE4) or dark purple (a bit more purple than 10R5/4), and often paler around centre (e.g. 10D4, 10D5), but sometimes dark violet (10DE5/4), with age with yellowish tinges from context. **Lamellae**, L = 40-45, l = 0-3, moderately to rather crowded, free, often distinctly so and up to 2 mm from stipe, ventricose or slightly ventricose, up to 3 mm wide, pale cream to distinctly cream or yellowish tinged especially so in older specimens, sometimes with pinkish tinges, with white cystidioid edge. **Stipe** 18-90 x 0.75-4 mm, sometimes bulbous, in most cases becoming wider downwards, up to 8 mm at base, often slightly compressed

in lower half, white in upper half, yellowish in lower half and in basal part with hints of lilac and purple, smooth, or slightly cystidiose above annulus, and sometimes slightly fibrillose in lower part, hollow. **Annulus** in general quite flimsy and not persistent, consisting of a small white cuff, irregularly ragged at lower edge, and a small flaring white part, with rim of pink-purplish material as on pileus, in half of the collections completely coloured on the outside, lilac like pileus, and white on the inside. **Context** white, thin and dull in pileus, white to whitish and shiny in stipe. **Smell** very weak and indistinct, fungoid, or sweet and like rubber (as *Lepiota cristata* (Bolton : Fr.) P. Kumm.). **Taste** not recorded. **Spore print** white.

Basidiospores [105, 7, 7] in side-view 6.7-9.8 x 3.8-5.7 μm , on average 7.4-8.3 x 4.2-4.9 μm , Q = 1.4-2.3, average Q = 1.55-1.95, oblong to subcylindrical, many amygdaliform often with distinct though small apical papilla, in frontal

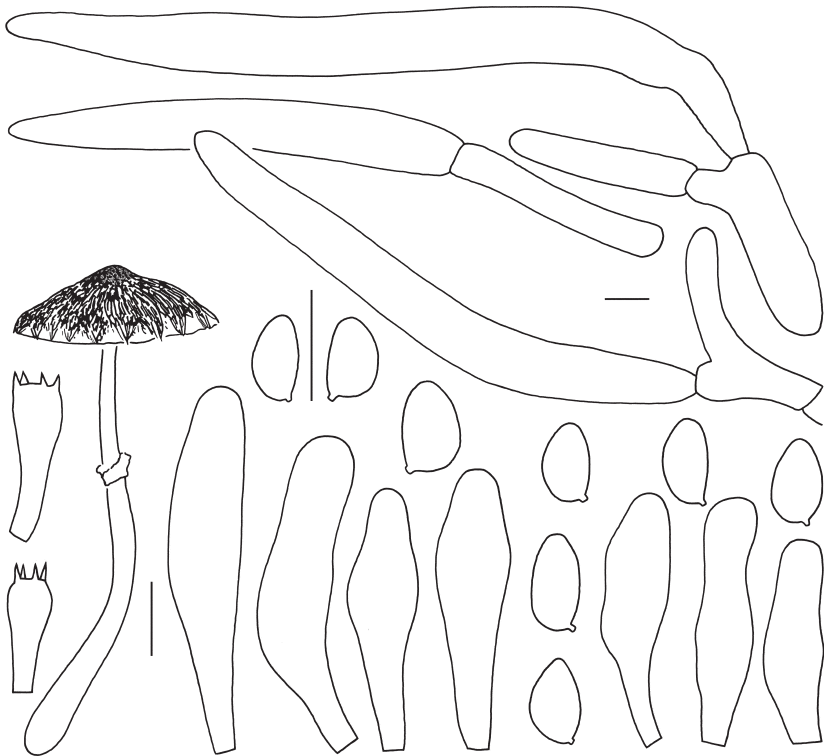


Fig. 2: *Lepiota roseolivida* – basidiocarp (ecv2586), spores (left three from ecv 2990; ecv3075), basidia (ecv3075), cheilocystidia (left four from ecv2990; ecv3075), elements of pileus covering (ecv3075). Scale bar 10 μm .

view oblong, with or without apical small papilla, thick-walled, colourless, dextrinoid, congophilous, and metachromatic in Cresyl blue. **Basidia** 15-26 x 6-9 μm , 4-spored, rarely 2-spored. Lamella edge sterile; **cheilocystidia** 21-62 x 5.5-13 μm , variable in shape, from narrowly utriform to wavy cylindrical or narrowly clavate, slightly thick-walled, colourless. **Pleurocystidia** absent. **Pileus covering** a loose cutis made up of repent hyphae, with terminal elements 60-190 x 8-12 μm , cylindrical or tapering towards apex; pigment intracellular and pinkish-lilac, more brown in older and dried material; cells further away from the apices with encrusting brownish pigments. **Stipe** covering a cutis of narrow, 2-3 μm wide hyphae with pale coloured walls; occasional hyphae with pigmented walls; below annulus with scattered hyphae as in pileus covering. **Clamp connections** absent.

Habitat and distribution – Solitary or in small groups, terrestrial and saprotrophic, in various forests, e.g. redwood forests and Monterey cypress groves, but also along a path in a more ruderal setting, widespread, and not uncommon, end of October-beginning of January.

COLLECTIONS EXAMINED – U.S.A., WASHINGTON, King Co., SEATTLE, SEWARD PARK, S.A. Trudell 95-293-01 (herb. Trudell) (Genbank nrITS EF121815); CALIFORNIA, Humboldt Co., PATRICK'S POINT STATE PARK, NEAR MUSSEL ROCK, 23.X.2003, E.C. Vellinga 3075; Mendocino Co., JACKSON STATE DEMONSTRATION FOREST, 'MUSHROOM CORNER', 22.XI.2003, D.E. Desjardin (coll. E.C. Vellinga 3129); 0.5 MILE SOUTH OF JUNCTION OF HIGHWAYS 1 AND 128, 17.XI.2006, E.C. Vellinga 3493; Marin Co., MUIR WOODS, 22.XI.1911, W.A. Murrill 1138 (Holotype, NY); POINT REYES, ALONG LIMANTOUR ROAD, 4.XI.2005, E.C. Vellinga 3348; POINT REYES, BAYVIEW TRAIL, 22.XI.2006, D. DeShazer 531; MOUNT TAMALPAIS, BOLINAS-FAIRFAX ROAD, 15.XI.2005, E.C. Vellinga 3368; Contra Costa Co., TILDEN REGIONAL PARK, ALONG UPPER PACKRAT TRAIL ABOVE JEWEL LAKE, 13.XI.1999, E.C. Vellinga 2378; *ibidem*, 4.XI.2000, E.C. Vellinga 2486 (Genbank nrLSU AY176395); *ibidem*, 23.XI.2001, E.C. Vellinga 2738; San Mateo Co., SAN FRANCISCO WATERSHED, 8.XII.2000, E.C. Vellinga 2586; *ibidem*, 7.I.2003, E.C. Vellinga 2990 (Genbank nrITS EF121816); *ibidem*, 5.XII.2003, E.C. Vellinga 3141; SAN MATEO Co. MEMORIAL PARK, ALONG POMPONIO TRAIL, northeast facing slope, 31.X. 2000, E.C. Vellinga 2475 (Genbank nrITS AY176394).

THE NETHERLANDS, prov. Noord-Holland, HEILOO, HEILOOËRBOSCH, 2.X.1996, F.A. v.d. Bergh (L); prov. Limburg, ELSLOO-GEULLE, BUNDERBOS, 9.IX.1996, E.C. Vellinga 2005 (L) (Genbank nrITS AF482866).

All collections in UC unless otherwise stated.

Comments – *Lepiota roseolivida* is a slender, elegant, fragile and unusually and subtly coloured little mushroom, which cannot be confused with any other species. Basidiocarp sizes vary, and basidiocarps with 5 mm wide mature pilei have been found in some habitats. The observations on the type collection are in agreement with those by Smith (1966).

Leucoagaricus marriagei is considered a synonym here. The macroscopic and microscopic characters of the two species are virtually identical, though

Reid (1966) described the spores as rather narrow (3.2-4 µm wide), which is not confirmed by measurements on Dutch material identified as *La. marriagei* (Vellinga 2001), where the spores were found to be 4.0-5.0 µm wide; Migliozi & Perrone (1991) described Italian collections with 3.7-4.1 µm wide spores.

European literature shows that there is some confusion about the differences between *La. marriagei* and *La. ionidicolor* Bellù & Lanzoni (e.g. Bon 1976), *La. tener* (P.D. Orton) Bon and *L. brunneocingulatus* (P.D. Orton) Bon. *Leucoagaricus ionidicolor* has more greyish bluish lilac tinges, is more robust with a relatively wider pileus, and the pileus covering consists of erect long tapering elements. *Leucoagaricus tener* is a brown fragile species, copiously provided with clear golden droplets when fresh, and *La. brunneocingulatus* is also brown-capped, lacking such drops.

Sequences of the nrITS (Vellinga 2004b and new sequences) show up to nine base differences among the three American collections sampled (Genbank accession numbers are provided with the collection data), and the sequence of the one sampled European collection falls within this variation. The four collections studied form a monophyletic group. All collections exhibit the same positive reaction in ammonia, but shape of spores and cheilocystidia shows some variation (Fig. 2).

Lepiota roseolivida has a weak reaction in ammonia; the pileus covering cells for instance exude a brownish pigment when placed in ammonia. The recognition of a separate variety, based on this character, seems superfluous, hence the placement of *La. marriagei* var. *ammovirescens* (Bon 1993) in the synonymy of *L. roseolivida*.

Lepiota roseolivida is known from western North America and Europe. It has not yet been recorded from other parts of North America, though its occurrence there is expected. It has been found regularly in coastal forests in the western parts of the U.S.A., but due to its small size, and the fact that it grows in small groups or solitarily, it can easily be overlooked. It is rare in Europe, but reported there occasionally (e.g. Henrici 2001 (United Kingdom), Migliozi & Perrone 1991 (Italy)).

2. *Lepiota decorata* Zeller

Figures 3-5

Lepiota pulcherrima Zeller, Mycologia 14: 186. 1922, non *Lepiota pulcherrima* P.W. Graff, 1914; *Lepiota decorata* Zeller, Mycologia 21: 103. 1929.

Leucoagaricus idae-fragum Guinb., Boisselet & G. Dupuy, Bull. trimest. Soc. mycol. Fr. 114 (3): 14. 1998.

Description of type collection (J.W. Severy & S.M. Zeller 2123 (NY)) (Fig. 3)

Zeller (1922): "Pileus 6-12 cm. broad, subhemispheric at first, then convex to quite plane, moderately fleshy, young buttons quite solid, acajon-red to Vandyke red at the center, venetian or alizarine-pink on the margin, often fading to a silvery livid-pink in age; cuticle on margins of older specimens split; surface appearing velvety because of the innate-pubescent towards the center, nearly glabrous or silky on the margin or squamulose when closely covered by another

pileus, becoming slightly appressed-scaly in age due to growth. Margin sterile. Flesh white, rather thin except disk. Gills free, white, close, broad, rounded behind, edges even. Stem 5-10 cm. long, 8-12 mm. thick, equal or tapering upward, slightly bulbous, peronate by a thin membrane colored like this pileus about one half to two thirds of the way up to the rather large, flaring, rather fleshy persistent annulus, white within, white to pinkish above the annulus. Spores smooth, white, oblong, 3-4.5 x 5-8 μ , usually uniguttulate. Pleasant flavor. Odor mildly farinose.

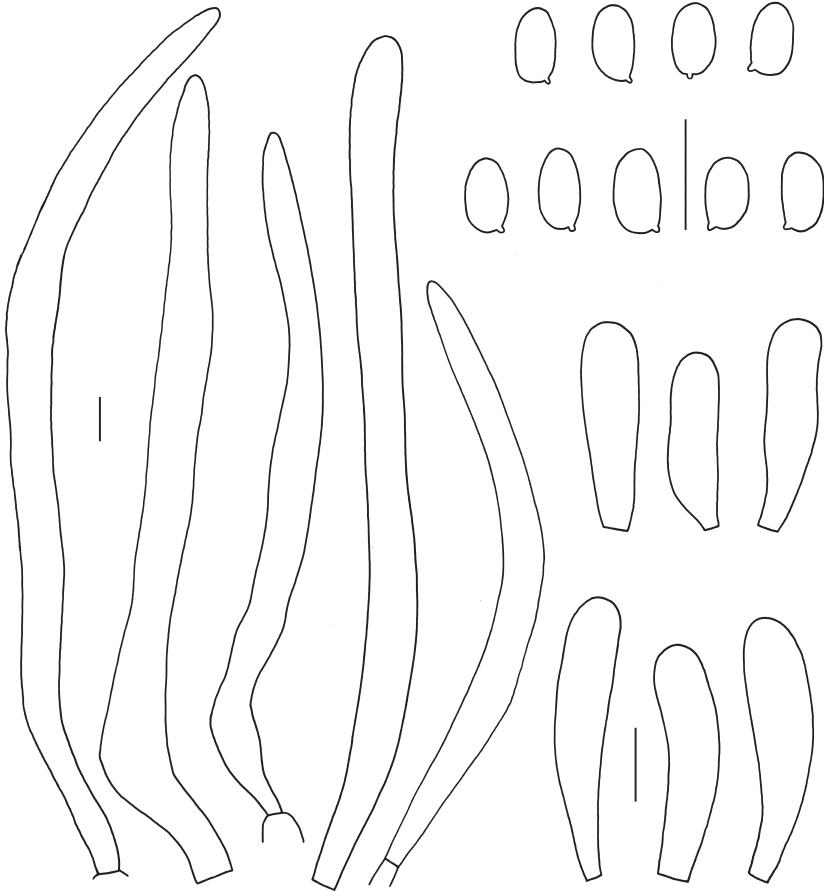


Fig. 3: *Lepiota decorata* – spores, basidia, cheilocystidia, elements of pileus covering (all from holotype). Scale bar 10 μ m.

Type study

Basidiospores [21,1,1] in side view 5.9-7.8 x 3.6-4.4 μ m, on average 6.6 x 4.0 μ m, Q = 1.45-1.9 average Q = 1.66, ellipsoid to oblong, with rounded apex, rarely amygdaliform, with central guttule, thick-walled and without germ

pore, congophilous, dextrinoid and metachromatic in Cresyl blue. **Basidia** 4-spored, difficult to revive. Lamella edge sterile; **cheilocystidia** 20-38 x 5.5-8.5 μm , narrowly clavate, cylindrical, thin-walled, colourless. **Pleurocystidia** not observed. **Pileus covering** made up of upright elements 100-240 x 7-13 μm , tapering towards apex, often widest above base, with brownish intracellular pigment, exuding pigment in ammonia. **Clamp connections** absent.

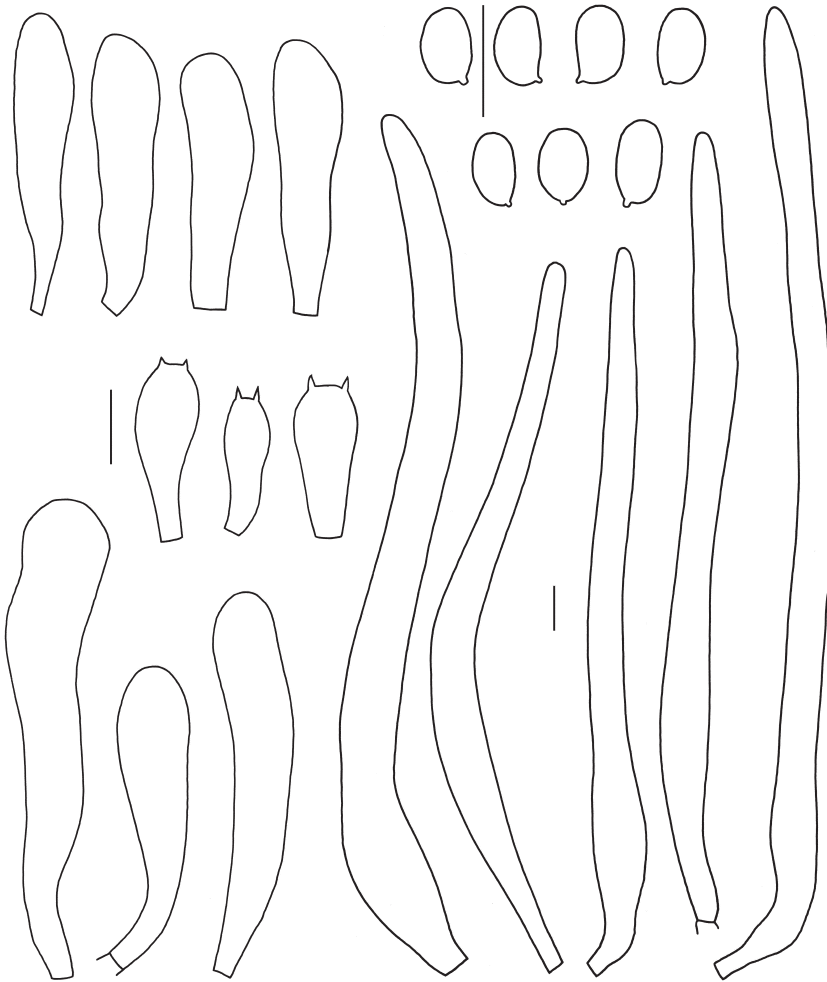


Fig. 4: *Lepiota decorata* – spores (ecv2810), basidia (ecv2810), cheilocystidia (upper ones from ecv2810; lower three from ecv3453), elements of pileus covering (left two from ecv2810; right from scale bar from ecv3190). Scale bar 10 μm .

Description of modern material (figs. 4-5)

Pileus 38-80 mm, campanulate with umbo, hemispherical-convex with inflexed margin when young, to wavy plano-convex with low umbo with age, beautiful rose-vinaceous purple, pink purplish, or pink-purple, darkest at centre, and slightly paler at margin (at centre 10D5, 10E5, around centre 10A3, 11C6-11C5, or in the range of 12AB3-4), velvety-tomentose at centre and closed, around centre in some places breaking open into small fibrillose adnate tufts on whitish background, or velvety to fine squamulose in outer part of pileus, in one specimen slightly radially fibrillose near margin; margin exceeding lamellae, entire or slightly fringed with age, white at first, brownish with age and pressure. **Lamellae**, L = 90-100, l = 0-3, crowded, free, but not remote from stipe, slightly or not ventricose, up to 7 mm wide, white to pale cream with white, irregularly eroded cystidiose edge. **Stipe** 75-90 x 7-11 mm, cylindrical, but in some specimens gradually widening towards base, at utmost base up to 14 mm wide, at apex white to whitish, when young only with some pink tinges at base, but with age below annulus with pinkish sheen or with a wash of lilac-rose (11A3-2), strongest near base, caused by long coloured adnate fibrils, and pubescent (lens!) in basal part, hollow, protruding into pileus; with copious white mycelium or mycelial mat at base. **Annulus** easily torn apart, consisting of an ascending or descending pale pink cuff with an up to 4 mm wide flaring part, with pink underside, concolorous with pileus or slightly paler, and dark pink rim, and white to pale pink inner upper side. **Context** relatively thick in pileus (c. 5 mm thick), white and dull, white to creamy shiny in stipe, not discolouring when cut. **Smell** astringent lepiotoid, strong and fungoid or indistinct. **Taste** and **spore print** colour not recorded.

Basidiospores [55,4,4] in side view 5.4-7.6 x 3.2-4.9 μm , $av_l \times av_w = 5.8-6.8 \times 3.7-4.0 \mu\text{m}$, $Q = 1.37-1.88$, $avQ = 1.47-1.71$, ellipsoid to oblong, with abaxial side in most spores straight, in most spores with rounded apex, rarely slightly amygdaliform, in frontal view ellipsoid-oblong, with one guttule, thick-walled, without a germ pore, dextrinoid, congophilous, and metachromatic in Cresyl blue. **Basidia** 18-36 x 6.5-8.5 μm , 4-spored, rarely 2-spored. Lamella edge sterile; **cheilocystidia** 23-65 x 7-13 μm , narrowly clavate, cylindrical, slightly utriform, colourless. **Pleurocystidia** absent. **Pileus covering** in young specimens more or less a cutis with long tapering terminal elements; these terminal elements more erect and giving a trichodermal aspect to covering in mature specimens; terminal elements 120-250 x 9-18 μm , cylindrical or slightly widened above base, with rounded apex, with pinkish or brownish intracellular pigment, and incrusting pigment in lower hyphae. **Stipe covering** of lower part of stipe a tomentum of narrow, 2-3 μm wide, interwoven hyphae with yellow refracting walls. **Clamp connections** absent.



Fig. 5: *Lepiota decorata* – basidiocarp (ecv3453; colour version available at <http://plantbio.berkeley.edu/~bruns/people/ev.html>). Photo by John Lennie.

Habitat and distribution – Solitary or in small groups, terrestrial in forests, ranging from old-growth forest with *Pseudotsuga menziesii*, a mixed *Acer macrophylla*, *Thuja plicata*, *Alnus rubra* wood to a *Eucalyptus* plantation with grassy undergrowth, rare, known from a handful of places in Oregon (Portland, Corvallis) and California (Contra Costa Co.); Sundberg (1967) and Burlingham (1945) mentioned three other coastal Californian localities, all with *Cupressus macrocarpa*; fruiting relatively late in the mushroom season; the type collection was made on November 1, but modern collections are all from the end of December; the species fruits into January at the Californian site.

COLLECTIONS EXAMINED – U.S.A., OREGON, Benton Co., CORVALLIS, 1 Nov. 1920, J.W. Severy & S.M. Zeller 2123 (NY); Multnomah Co., PORTLAND, 6720 NW SKYLINE BLVD, L.L. Norvell 2051224 (Pacific Northwest Mycology Service Herbarium); CALIFORNIA, Contra Costa Co., TILDEN REGIONAL PARK, E.C. Vellinga 2810 (GenBank nrITS AY243645); *ibidem*, 25 Dec. 2003, E.C. Vellinga 3190; *ibidem*, 24 Dec. 2005, E.C. Vellinga 3453 (all in UC).

Comments – This is one of the most beautiful fungi in California, easily recognized by its size and deep pink overall colours. Its colours change quickly after collecting, and the specimens exhibit a more pink colour in the field than after transport.

It fruits consistently late in the season, and has been found in Oregon and in California at the same time of the year. It is rare, and only encountered in a couple of localities.

Leucoagaricus idae-fragum has been described from several localities on the Atlantic coast of France (Guinberteau et al. 1998). The only difference with *L. decorata* is the often, but not always, persistent white velum on the pileus, and the slightly bigger spores, but all other characters are in concordance with *L. decorata* as described here. *Leucoagaricus idae-fragum* is considered a synonym of *L. decorata*. A very detailed description of *La. idae-fragum* was given by Guinberteau et al. (1998).

Lepiota decorata is a sister species to *Leucoagaricus ionidicolor* in the phylogenetic analyses of the nrITS sequences (Vellinga 2004b). *Leucoagaricus ionidicolor* shares the same type of pileus covering structure with *L. decorata*, but is a smaller, violaceous coloured species, occurring in Europe. *Leucocoprinus caeruleoviolaceus* D.A. Reid is a synonym of *La. ionidicolor*. It is a rare species, fruiting under relatively dry circumstances throughout Europe (e.g. Antonín & Vágner 1997, Vasas 2000, Vellinga 2001, Vila et al. 1997).

Lepiota decorata exhibits a disjunct distribution; it is so far known from the western parts of North America, and the western parts of France. Records of this species from other parts of North America could be expected.

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Literature cited

Antonín V, Vágner A. (1996) 1997. New, rare and less known macromycetes in Moravia (Czech Republic) - III. Acta Mus. Moraviae, Sci. nat. 81: 147-156.

- Bon M. 1976. Lépiotes rares, critiques ou nouvelles aux Dreiländertagung d'Emmendingen, septembre 1975. Bull. trimest. Soc. mycol. Fr. 92: 317-334.
- Bon M. 1993. Novitates 4. Famille *Lepiotaceae* Roze ex Overeen. Doc. mycol. 22 (88): 27-32.
- Burlingham GS. 1945. Noteworthy species of *Lepiota* and *Lactaria*. Mycologia 37: 53-64.
- Guinberteau J, Boisselet P, Dupuy G. 1998. *Leucoagaricus idae-fragum*, sp. nov., un nouveau *Leucoagaricus* des dunes atlantiques françaises de coloration rose framboise. Bull. trimest. Soc. mycol. Fr. 114 (3): 1-18.
- Henrici A. 2001. Fungal Portraits No. 8: Seven species of *Leucoagaricus*. Field Mycology 2: 111-112, 133.
- Kornerup A, Wanscher JH. 1974. Farver i Farver. København, Politikens forlag.
- Migliozzi V, Perrone L. 1991. Sulle Lepiotee - 3^o contributo. *Leucoagaricus marriagei* (Reid) Bon. Boll. Ass. micol. ecol. Romana 22: 23-30.
- Munsell soil color charts. 1975. Baltimore.
- Murrill WA. 1912. The *Agaricaceae* of the Pacific Coast II. Mycologia 4: 231-262.
- Reid DA. 1966. Coloured illustrations of rare and interesting fungi. Part 1. Supplement to Nova Hedwigia 11: 1-32.
- Smith HV. 1966. Contributions toward a monograph on the genus *Lepiota*, I. Type studies in the genus *Lepiota*. Mycopath. & Mycol. appl. 29: 97-117.
- Sundberg WJ. 1967. The family *Lepiotaceae* in California. Master's thesis, San Francisco State University. 219 pp.
- Vasas G. 1999-2000. Contributions to the knowledge of macrofungi of the forests along the Fekete-Koros, SE Hungary. Stud. bot. Hung. 30-31: 79-86.
- Vellinga EC. 2001. *Leucoagaricus*. In ME Noordeloos, ThW Kuyper, EC Vellinga (eds). Flora agaricina neerlandica 5: 85-108. Lisse/Abingdon/Exton (PA)/Tokyo, A.A. Balkema Publishers.
- Vellinga EC. 2004a. Ecology and distribution of lepiotaceous fungi – a review. Nova Hedwigia 78: 273-299.
- Vellinga EC. 2004b. Genera in the family *Agaricaceae* – Evidence from nrITS and nrLSU sequences. Mycol. Res. 108: 354-377.
- Vila J, Rocabrana A, Llistosella J, Tabarés M, Llimona X. 1997. Algunos hongos nuevos o interesantes de la península ibérica. Rev. catalana Micol. 20: 169-176.
- Zeller SM. 1922. Contributions to our knowledge of Oregon fungi I. Mycologia 14: 173-199.
- Zeller SM. 1929. Contribution to our knowledge of Oregon fungi – III. Mycologia 21: 97-111.