

MYCOTAXON

Vol. XXII, No. 2, pp. 419-434

April-June 1985

STUDIES IN AGARICUS III: NEW SPECIES FROM CALIFORNIA¹

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Abstract

Eight new species of Agaricus from California are described. They are: Agaricus sequoiae, section Agaricus subsection Agaricus; A. vinaceovirens, section Agaricus subsection Bitorques; A. fuscovelatus and A. rubronanus, section Sanguinolenti; A. arorae, section Spissicaules; and A. smithii, A. summensis, and A. perobscurus in the section Arvenses.

Beginning with the publication of Agaricus californicus Pk. in 1895, thirteen new Agaricus taxa based on material from California have to date been published. These include A. bulbosus McClatchie, A. bivelatus Pk., A. subnitens Pk., A. pattersonae Pk., A. hondensis Murr., A. abramsii Murr., A. mcmurphyi Murr., A. crocodilinus Murr., A. albolutescens Zell., A. glabrus Zell., A. liliceps Zell., and A. placomyces Pk. var. microsporus A. H. Smith. A majority of these taxa are currently recognized as distinct. It is worth noting that of the thirteen only A. bulbosus was proposed by a collector residing in the state.

It is becoming increasingly apparent that California supports a great diversity of Agaricus species, including many new ones which may have restricted distributions. Forty-five species of Agaricus have been collected by the author in the state since 1972. Fourteen of these are undescribed, and of this group eight are described below.

1) Portion of a thesis submitted to San Francisco State University in partial fulfillment of the requirements for the M.A. in Biology.

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Agaricus species occur in many habitats in California. One of the most significant of these is the Monterey cypress (Cupressus macrocarpa Hartw.) grove habitat, from which more than twenty-five species of Agaricus have been recorded. Other new and interesting species have come from the extensive redwood (Sequoia sempervirens (D. Don) Endl.) forests, and from the mixed evergreen forest community (Pseudotsuga and Quercus).

Materials, methods, and conventions: Formulae for the reagents mentioned below are as follows:

KOH: a 3% aqueous solution

Aniline: pure, fresh

HNO₃: concentrated

2,4³-Dinitrophenylhydrazine: a saturated ethanolic solution

o-Tolidine: 0.05 g in 3.5 ml of ethanol, + 6.5 ml of distilled H₂O

alpha-Naphthol: 0.5 g in 3.5 ml of ethanol, + 6.5 ml of distilled H₂O

These reagents are applied to the pileus surface unless otherwise noted. Aniline x HNO₃, or "Schaeffer's reaction," involves streaking aniline upon the pileus surface, followed by cross-streaking HNO₃; the reaction occurs at or near the junction of the cross.

Microscopic features were generally determined from dried material mounted in KOH (3%); rarely fresh material was used. Spore measurement data were obtained as described in Kerrigan (1982). Measurements and shapes refer to spores in profile view. Shape terminology and criteria are those of Bas (1969).

The plural term "veils" refers to the two distinctly different velar layers possessed by most, if not all, species of Agaricus. The partial veil extends from the apex of the stipe, across the hymenophoral cavity, to the tramal zone at the pileus margin. The universal veil surrounds the entire sporocarp primordium and apparently also extends between the stipe and the partial veil of the immature, unexpanded sporocarp. The annulus is typically composed of both layers. See also Atkinson (1914) and Romagnesi (1977) on the veils of Agaricus.

Color terms enclosed in quotation marks are from Ridgway (1912). Spore color refers to a spore deposit on white paper; this feature has not been found to vary greatly in Agaricus. Specimens cited below are deposited in the San Francisco State University Herbarium (SFSU).

Agaricus sequoiae sp. nov.

Fig. a.

Pileus 4-14 cm latus, subcylindricus vel convexus demum late convexus, laxe intertextus vel squamosus, albus;

contextus albus, immutabilis; odor mitis; stipes 8-30 cm longus, 1.8-3.0 cm crassus, plerumque aequalis, e farcto cavus; vela alba, interdum ex parte flavescens; sporae (6.4-) 7.1-7.9 (-9.0-10.1) x (4.1-) 5.0-5.3 (-6.4) μm ; basidia 30-40 x 7-13 μm , tetraspora; cheilocystidia nulla. Holotypus: R. W. Kerrigan 824, Mendocino Woodlands Camp, Mendocino Co., California. 20 November 1977. SFSU.

PILEUS 4-14 cm broad, convex to cylindrical, becoming very broadly convex, sometimes somewhat truncate; surface dry, fibrillose, the fibrils loosely interwoven, not tightly appressed, typically forming squamae (ca. 2-5 x 1-3 mm) with erect tips, colored white to light buff; background indistinguishable; context white, unchanging, semi-firm, to 2.5 cm thick, odor and taste mild.

LAMELLAE free, close, to 1.5 cm broad, pink to dull pink, "Fawn Color," becoming dark blackish brown, margin concolorous.

STIPE 8-30 cm long x 1.8-3.0 cm broad, equal or rarely ventricose; interior white, unchanging, stuffed-hollow, the cavity sometimes quite large; surface glabrous above, scurfy below, white, not changing immediately, but brownish, "Warm Sepia" stains sometimes developing long after handling; base deeply rooted in dense, silty soil.

VEILS white, sometimes in part becoming about "Primuline Yellow" in age, forming a scant to copious, friable, pendant or intermediate, suprmedian annulus, or a series of annular bands, and/or a fringe of coarse, fibrillose squamules, often united at their tips, on the pileus margin, as well as various, often extensive remnants on the lower stipe.

SPORES (6.4-) 7.1-7.9 (-9.0-10.1) x (4.1-) 5.0-5.3 (-6.4) μm , dark brown, ellipsoid, hilar appendix rather prominent, germ pore not evident. BASIDIA 30-40 x 7-13 μm , clavate to cylindro-clavate, tetrasporic; sterigmata 3-4 μm long. CHEILOCYSTIDIA absent or basidiole-like. PILEIPELLIS of parallel or sub-parallel to interwoven, hyaline, smooth, thin-walled hyphae, cells (4.5-) 7.5-30 x 33-110 μm , cylindrical, or constricted at septae, or rarely ellipsoid.

CHEMICAL REACTIONS: KOH negative; aniline x HNO_3 negative; o-tolidine blue on basal stipe context, adjacent velar material, and pileus surface, elsewhere unchanging; alpha-naphthol pink on annulus, pileus surface, elsewhere essentially unchanging.

Solitary, gregarious, or caespitose (up to 50 per fascicle) in periodically-silted bottomlands in redwood forests. Known only from Mendocino County (possibly observed in Marin County), California. Oct. - Dec. Usually rare but occasionally almost common.

Material studied: CALIFORNIA. Mendocino Co.: R. W. Kerrigan 623, 744, 795-797, 809-813, 820-823, 824 (holotype), 825-827, 1083; K. Williams 239K77.

Observations: The unchanging color of the context, chemical reactions, and the absence of cheilocystidia place A. sequoiae in section Agaricus subsection Agaricus sensu Heinemann (1978). The unusual yellow tints that develop on the veil, as well as the typically large size, distinguish the species. Of the European species, A. chionodermus Pilát appears to most closely resemble A. sequoiae, but has larger spores. Locally, in its habitat, A. sequoiae will probably not be confused with other species, except perhaps with very pallid specimens of A. hondensis, which have a phenolic odor and turn yellow with KOH. At this point A. sequoiae appears to be restricted to those portions of the coastal redwood forest which are periodically inundated with turbid water from adjacent rivers. In the last 10 years it has been relatively abundant during only one season.

Agaricus vinaceovirens sp. nov.

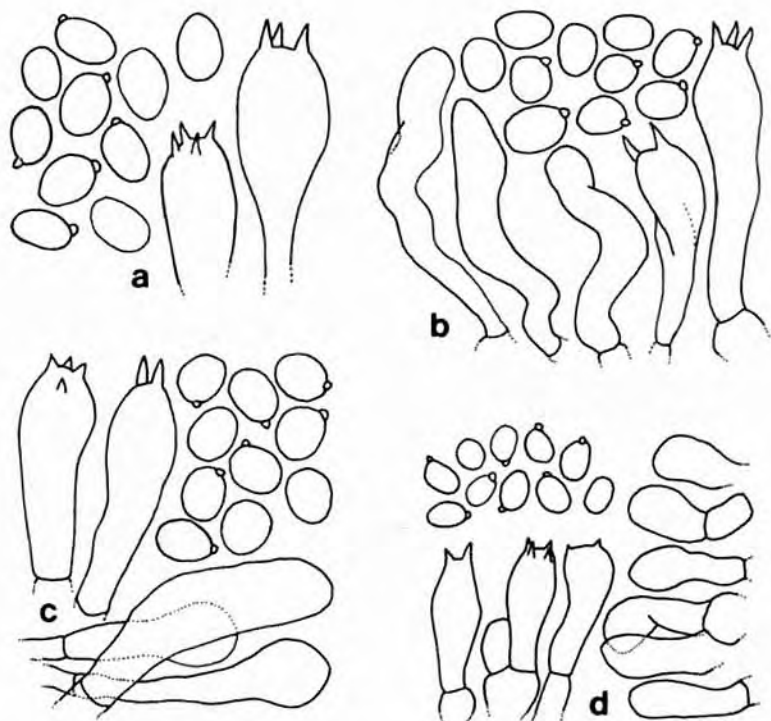
Fig. b.

Pileus 6-12 cm latus, convexus, margine valde involutus, demum subplanus vel depressus, laxe intertextus vel subsquamulosus, albus vel vinaceus, interdum ex parte virescens; contextus albus, immutabilis vel juxta cuticulam vinaceus, interdum virescens; odor mucido-salinus, ingratus; stipes 1.5-6 cm longus, 2-4 cm crassus, subaequalis, solidus; vella alba demum vinaceo-suffusa, peronata, saepe cupulata; spores (5.3-) 6.2-6.7 (-7.9) x (4.1-) 4.6-5.0 (-5.6) μ m; basidia 25-36 x 7.5-9 μ m, tetraspora; cheilocystidia 17-39 x 6-10.5 μ m, undulata vel irregularia. Holotypus: R. W. Kerrigan 730, Colma, San Mateo Co., California. 7 October 1977. SFSU.

PILEUS 6-12 cm broad, broadly convex, sometimes depressed centrally, with strongly inrolled margin, finally almost plane; surface dry, with loosely interwoven, appressed to slightly repent fibrils, towards the margin often with semi-erect, pointed squamules, colored white to light brown, "Chamois," in age usually developing vinaceous tints, especially toward the margin, occasionally greenish tints also developing, especially near the disc; context white, unchanging after exposure except after several hours a narrow band below surface becoming vinaceous, also occasionally a second band colored "Tea Green" to "Celandine Green" developing directly below surface, firm, to 2.5 cm thick, odor strong, unpleasant, musty/briny.

LAMELLAE free, close, 3-8 mm broad, pallid salmon color, or more brownish, becoming dark blackish brown, margin pallid or obscurely so.

STIPE 1.5-6 cm long x 2-4 cm above, 2-3 cm below, equal, clavate to napiform, or cuneiform; interior white,



Figs. a-d. Basidia, basidiospores, and cheilocystidia of *Agaricus* spp.
 a. *A. sequoiae*, Kerrigan 795 (cheilocystidia lacking). b. *A. vinaceovirens*, Kerrigan 730. c. *A. fuscovelatus* Kerrigan 784. d. *A. rubronanus*, Kerrigan 1204. All $\times 900$.

unchanging, solid; surface glabrous where exposed (above veils), white, unchanging; base firmly rooted in substrate.

VEILS peronate, continuous from base, forming a saccate or appressed volva, with or without flaring, striate, upper limb, colored white, developing vinaceous tints above, loosely interwoven, appearing coactate.

SPORES (5.3-) 6.2-6.7 (-7.9) \times (4.1-) 4.6-5.0 (-5.6) μm , dark brown, ellipsoid, hilar appendix prominent, germ pore not evident. BASIDIA 25-36 \times 7.5-9 μm , clavate to cylindro-clavate, frequently predominantly trisporic, otherwise predominantly tetrasporic; sterigmata 2-4 μm long. CHEILOCYSTIDIA 17-39 \times 6-10.5 μm , cylindro-clavate, usually contorted, lining the lamellar margin. PILEIPELLIS of semi-parallel to interwoven, smooth, thin-walled, hyaline hyphae, cells (3.5-) 6-9 (-12) \times 30-80 (-190) μm , convoluted-cylindrical, often sharply curved.

CHEMICAL REACTIONS: KOH negative; aniline \times HNO_3 negative; o-tolidine blue on surfaces and veils, sometimes

blue on context near surface at pileus margin, also on basal 2-3 mm of stipe context; otherwise unchanging; alpha-naphthol bright magenta on pileus cuticle and veils, otherwise unchanging.

Gregarious, always in rings in litter or soil under Cupressus macrocarpa. Known only from the San Francisco Peninsula. Oct. - Mar. Uncommon.

Material studied: CALIFORNIA. San Francisco Co.: R. W. Kerrigan 660, 664, 912, 913, 925, 926, 928, 929, 1005, 1009, 1196. San Mateo Co.: R. W. Kerrigan 667, 705, 706, 730 (holotype), 895, 896, 995, 997, 998, 1010, 1040.

Observations: The solid stipe, peronate veils, and strongly inrolled pileus margin place A. vinaceovirens in section Agaricus subsection Bitorques Heinem. The manner in which the vinaceous tints appear is distinctive, while the greenish tones, although only occasionally present, are to my knowledge unique among known species of Agaricus. The general habit, contorted cheilocystidia, and odor of brine are also shared by A. bernardii Quel. apud Cooke & Quel.; however that species is strongly rufescent, and its odor is neither musty nor particularly unpleasant. The odor of A. vinaceovirens is objectionable enough to provoke requests for removal of the specimens from a room. Agaricus bitorquis (Quel.) Sacc. also has a similar habit, however the pileus is usually glabrous, the odor is mild or pleasant, and the cheilocystidia are not contorted. In addition to these distinctions, all three of the species mentioned above have substantially different spore sizes.

Agaricus fuscovelatus sp. nov.

Fig. c.

Pileus 5-9 cm latus, conico-convexus demum subplanus, appreso-squamulosus vel fibrilloso-areolatus, cinnamomeus vel obscure cinnamomeus, sub fibrillis pallide violaceo-griseus; contextus ex albo rufescens; odor mitis, suavis; stipes 6-12 cm longus, 0.8-1.5 cm crassus, deorsum 1-2 cm crassus, sub aequalis, e farcto cavus; vela pendentia, albida demum fusca; spores (5.6-6.4-) 7.2-7.8 (-9.0) x (4.9-) 5.7-6.2 (-7.1) μ m; basidia 27-30 x 9-10 μ m, tetraspora; cheilocystidia 21-47 x 7.5-12 μ m, cylindrica, clavata vel subsphaeropedunculata. Holotypus: R. W. Kerrigan 791, Sunset Avenue, San Francisco Co., California. 8 November 1977. SFSU.

PILEUS 5-9 cm broad, hemispherical, or compressed, becoming conico-convex, finally almost plane; surface dry, appressed-fibrillose becoming squamulose, or fibrillose-areolate, or scurfy, at first colored medium brown, about "Avellaneous," later "Buffy Brown," "Buckthorn Brown," "Cinnamon-Brown," or darker after handling or with age; background colored whitish or more often "Pale Mouse Gray" or "French Gray," producing an overall subtle violet-grey cast; context white, slowly and weakly to moderately

rufescent, to 1 cm thick, odor after exposure becoming fruity/spicy.

LAMELLAE free, close, to 7 mm broad, greyish-pink becoming dark blackish brown.

STIPE 6-12 cm long x 8-15 mm above, 1-2 (-2.5) cm at broadest part, equal or rarely enlarged below or slightly ventricose; interior white, moderately rufescent throughout its length, especially in transverse section; surface smooth above, faintly fibrillose with velar fragments below, white, moderately strongly reddening when incised; base (1-1.5 cm) covered with soil.

VEILS forming a thin, pendant, apical to subapical, colored annulus dehiscing from pileus margin when pileus is approximately half-expanded, then collapsing; partial veil white, soon becoming "Drab," finally dark brown, "Carob Brown" to "Benzo Brown," especially below; universal veil primarily forming a thicker, whitish to "Cinnamon-Brown" dentate fringe on pileus margin, also sometimes leaving a ring of warts under the partial veil near the annular margin, or leaving very thin, darkening patches beneath entire partial veil, also forming small warts or, rarely, a scale-like ring on lower stipe.

SPORES (5.6-6.4-) 7.2-7.8 (-9.0) x (4.9-) 5.7-6.2 (-7.1) μm , dark brown, broadly ellipsoid to ellipsoid, hilar appendix conspicuous, germ pore not evident. BASIDIA 27-30 x 9-10 μm , clavate to ventricose, tetrasporic; sterigmata 3-5 μm long. CHEILOCYSTIDIA 21-47 x 7.5-12 μm , broadly cylindrical, clavate, or slightly sphaeropedunculate, in clusters, with basidia present on lamellar margin. PILEIPELLIS of parallel or sub-parallel to semi-interwoven, smooth, thin-walled hyphae, appearing very pale reddish brown under oil at 1000x, cells (2-) 4.5-9 x 30-105 μm , contorted.

CHEMICAL REACTIONS: KOH negative; aniline x HNO_3 negative; o-tolidine blue on surface of stipe base, pileus cuticle, elsewhere violet; alpha-naphthol purple on surface of stipe base, pileus cuticle, elsewhere orange to pinkish-orange except unchanging on basal context of stipe.

Gregarious, sometimes abundantly so, to caespitose, sometimes in arcs, usually deeply rooted in bare, compacted, often coarse-textured soils, generally under various planted conifers (Cupressus, Abies, Cedrus, Pinus). Known from central coastal California. Sept. - Jan. Rather common.

Material studied: CALIFORNIA. Marin Co.: R. W. Kerrigan 951. San Francisco Co.: R. W. Kerrigan 683, 695, 790, 791 (holotype), 849. San Mateo Co.: R. W. Kerrigan 701, 779, 945, 996, 1006. Santa Cruz Co.: R. W. Kerrigan 934, 1013, 1014. Monterey Co.: R. W. Kerrigan 976, 1031.

Observations: Agaricus fuscovelatus is similar to A. pattersonae in many respects; for example the veils of both species become brown in age, however this is much less pronounced in A. pattersonae. Of the two, A. fuscovelatus has a smaller, more slender stature, and a more conic pileus when young. The violet-grey cast of the pileus background is subtle but with experience can be used to recognize the mushroom in the field. Agaricus annae Pilát appears to be similar but has longer, narrower spores; unfortunately Pilát published no information on the veils of that species.

Agaricus rubronanus sp. nov.

Fig. d.

Pileus 2-3 cm latus, conico-convexus demum subplanus, appresso-fibrillosus vel appresso-squamulosus, cinnamomeus, sub fibrillis pallidus; contextus ex albo rufescens; odor mitis; stipes 3.5 cm longus, 3-6 mm crassus, basi 8 mm crassus, aequalis vel subbulbosus, e farcto cavus; sporae (3.8-4.1-) 4.8-5.0 (-6.0-6.8) x (3.0-) 3.6-3.7 (-4.1-4.5) μ m; basidia 15-22 x 6-7 μ m, tetraspora; cheilocystidia 10-16 x 5-6 μ m, cylindrico-clavata. Holotypus: R. W. Kerrigan 1204, Colma, San Mateo Co., California. 7 December 1981. SFSU.

PILEUS 2-3 cm broad, shape when young unknown, later convex-truncate, finally approximately plane; surface dry, appressed-fibrillose becoming appressed-squamulose, squamules small (ca. 2-3 mm), pointed, colored medium brown, "Wood Brown," or darker in age; background pallid, quickly becoming red when bruised, especially on margin; context white, quickly strongly reddening when exposed, to 4 mm thick, odor indistinct.

LAMELLAE free, close, to 4 mm broad, pinkish, bruising rose color, becoming brownish, then blackish brown, margin pallid.

STIPE 3.5 cm long x 3-6 mm broad above, to 8 mm broad at base, equal or slightly bulbous; interior white, quickly moderately to strongly rufescent when sectioned, especially above, somewhat yellowish near base, lustrous, somewhat fibrous, stuffed-hollow; surface finely striate above, fibrillose below, becoming zonate in lower half, white, rufescent where incised, becoming brownish after handling or with age; base shallowly rooted in litter.

VEILS forming a thin (ca. 1 mm), scant, pendant, suprmedian, white annulus with "Wood Brown" margin, upper surface finely striate, lower surface slightly scurfy, some velar remnants also present as occasional dentate flaps on pileus margin, and as fibrils on stipe.

SPORES (3.8-4.1-) 4.8-5.0 (-6.0-6.8) x (3.0-) 3.6-3.7 (-4.1-4.5) μ m, dark brown, broadly ellipsoid to ellipsoid, hilar appendix prominent, germ pore not evident. BASIDIA

15-22 x 6-7 μm , typically ventricose, tetrasporic; sterigmata 2-3 μm long. CHEILOCYSTIDIA 10-16 x 5-6 μm , cylindro-clavate, scattered, with basidia also present on lamellar margin. PILEIPPELLIS of interwoven to sub-parallel, convoluted, branching, smooth, thin-walled hyphae, appearing light reddish-brown under oil at 1000x, cells 3-4.5 (-8) x 30-75 μm , contorted-cylindrical.

CHEMICAL REACTIONS: KOH negative.

Scattered in litter of Cupressus macrocarpa. Known only from San Mateo County, California. Dec. Rare.

Material studied: CALIFORNIA. San Mateo Co.: R. W. Kerrigan 1204 (holotype).

Observations: The most striking feature of A. rubronanus is its diminutive size. It might at first be mistaken for the more common A. semotus Fr., or a similar species, until the rufescence of the context is noted. Agaricus placomyces var. microsporus is another small, rufescent, very rare species which has a blackish, rather than a brown, pileus. Other small-spored species in section Sanguinolenti (Schaeff. & Møll.) Sing. are considerably larger. The most similar of these, A. silvaticus Schaeff. ex Secr. sensu Møll. (which incidentally has not been found in California), has a pileus which is 5-10 cm broad, and much larger cheilocystidia.

Agaricus arorae sp. nov.

Fig. e.

Pileus 3-10 cm latus, convexus demum subplanus, undulatus, fibrilloso-squamulosus, fuscus vel olivaceus, sub fibrillis pallidus; contextus ex albo rufescens; odor mitis, suavis; stipes 5-11 cm longus, 0.7-1.2 cm crassus, deorsum 1.5-3 cm crassus, bulbosus, reliquias velorum praebens, e farcto cavus; vela alba, pendentia; spora (4.1-) 4.5-4.7 (-5.6) x (3.0-) 3.3-3.4 (-3.8) μm ; basidia 20-24 x 6 μm , tetraspora; cheilocystidia 14-25 x 6-13.5 μm , clavata, late clavata vel pyriforma. Holotypus: R. W. Kerrigan 1199, Capitola Extension, Santa Cruz Co., California. 25 November 1981. SFSU.

PILEUS 3-10 cm broad, convex, becoming broadly convex to hemispherical, finally plane, undulating; surface dry, fibrillose, later with small (ca. 2-4 x 1-2 mm) appressed fascicles of fibrils (scarcely squamules) with tips which may recurve in age, colored medium dark brown, "Sayal Brown" to "Tawny-Olive;" background color whitish, becoming sordid; context white, reddening (variably so) when cut, semi-firm, 4-7 mm thick, odor fruity/spicy upon exposure, almond-like with KOH.

LAMELLAE free, close, to 5 mm broad, when young dull pinkish, bruising more rosy color, later dull blackish brown, margin concolorous.

STIPE 5-11 cm long x 7-12 (-17) mm above, 15-30 mm at base, slender, bulbous; interior white, moderately to semi-strongly rufescent upon exposure, somewhat lustrous, stuffed-hollow; surface white, coloring as the interior when bruised, finely striate and lustrous above where not covered by extensive, thin velar zones which remain white as surface darkens, glabrous below, with 0-3 thicker, white (occasionally brown-tipped) scale-like rings; base rather deeply rooted in substrate.

VEILS forming a thin, pendant, suprmedian, white annulus with blunt, entire margin, partial veil and universal veil indistinguishable, also leaving remnants on stipe as described above.

SPORES (4.1-) 4.5-4.7 (-5.6) x (3.0-) 3.3-3.4 (-3.8) μ m, dark brown, ellipsoid, hilar appendix not prominent, germ pore not evident. BASIDIA 20-24 x 6 μ m, clavate, tetrasporic; sterigmata 2-3 μ m long. CHEILOCYSTIDIA 14-25 x 6-13.5 μ m, basidiole-like or more broadly clavate, to pyriform, uncommon to common and almost continuous, with scattered basidia on lamellar margin. PILEIPELLIS primarily of interwoven, much-branching, smooth, thin-walled hyphae, appearing very light brown under oil at 1000x, cells 6-9 (-14) x 18-48 μ m, cylindrical or slightly constricted at the septae.

CHEMICAL REACTIONS: KOH yellow; aniline x HNO_3 orange-red within one minute.

Gregarious and caespitose in deep litter of Quercus, sometimes in conjunction with other trees such as Pseudotsuga. Known only from Santa Cruz County, California. Nov. Rare.

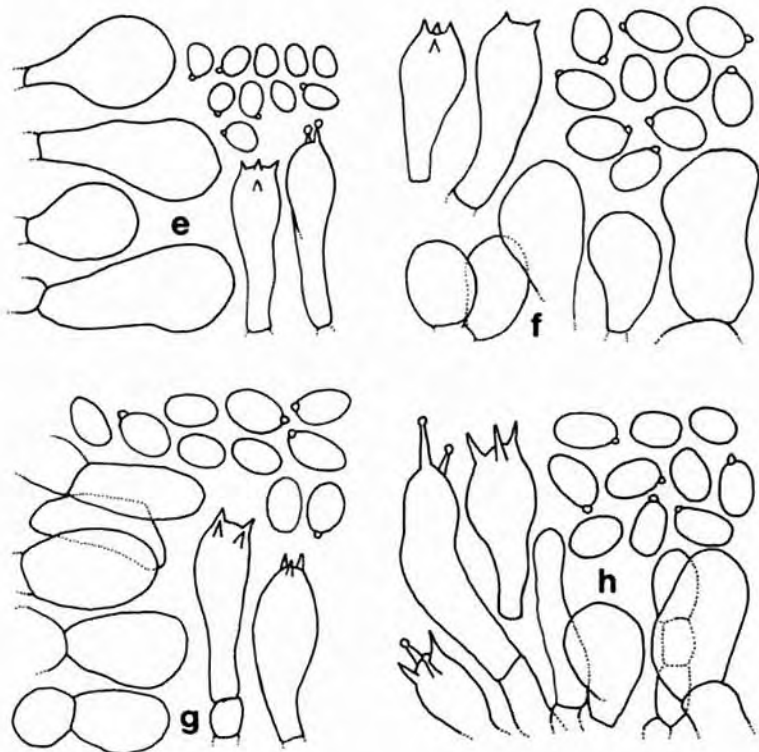
Material studied: CALIFORNIA. Santa Cruz Co.: R. W. Kerrigan 1180, 1199 (holotype).

Observations: The brown color of the pileus, slender stature, and rufescent context are common to many species of Agaricus, such as A. fuscofibrillosus (Møll.) Møll. A. arorae differs in giving positive reactions with the KOH and aniline x HNO_3 tests. The pale velar patches on the darkening surface of the upper stipe are also distinctive. It is placed in section Spissicaules (Heinem.) Kerrigan because of the combination of chemical reactions and rufescence of the context. A. arorae is named for D. Arora, who first brought specimens of this and other interesting species to me.

Agaricus smithii sp. nov.

Fig. f.

Pileus 8-13 cm latus, anguste convexus dein hemisphaericus demum planus, appresso-fibrillosus vel squamulosus, ochraceo-aurantiacus; contextus albus, immutabilis; odor amygdalinus; stipes 7-15 cm longus, 1-1.5



Figs. e-h. Basidia, basidiospores, and cheilocystidia of *Agaricus* spp. e. *A. arorae*, Kerrigan 1180, 1199. f. *A. smithii*, Thiers 24356. g. *A. summensis*, Kerrigan 661, 662. h. *A. perobacurus*, Kerrigan 643. All x 900.

cm crassus, deorsum 2-4 cm crassus, bulbosus vel abrupte bulbosus, e farcto cavus, albus demum lutescens; vela alba, pendentia; spora (6.4-) 7.4-8.3 (-9.8) x (4.5-) 5.0-5.6 (-6.4) μ m; basidia 18-24 x 9-10.5 μ m, tetraspora; cheilocystidia 9-22.5 x 7.5-13.5 μ m, clavata, ovoidea, vel globosa. Holotypus: H. D. Thiers 21494, Patrick's Point State Park, Humboldt Co., California. 12 November 1967. SFSU.

PILEUS 8-13 cm broad, narrowly convex becoming broadly convex, finally plane; surface dry, appressed-fibrillose becoming minutely appressed-squamulose, the squamules ca. 2-3 mm long x 1-2 mm broad, pointed, colored orangish, near "Tawny," background pallid, generally becoming yellowish-orange; context white, unchanging, to 1.5 cm thick, odor almond-like.

LAMELLAE free, close, to 1 cm broad, dull pinkish becoming greyish, finally dark blackish brown, margin pallid.

STIPE 7-15 cm long x 1-1.5 cm above, 2-4 cm at base, bulbous or more often abruptly bulbous; interior white, or yellowish near base, unchanging, stuffed-hollow, to hollow in age; surface glabrous above, covered below when young with a continuous layer of velar fibrils, white, becoming yellow; base shallowly rooted in substrate, with many yellowish mycelial strands.

VELLS forming an ample, pendant (or pendant-upturned), subapical to suprmedian, white annulus; partial veil entire, smooth above, 1-2 mm thick; universal veil typically fissuring radially near margin to form a "cog-wheel" with obtuse points that may become tawny, also leaving deciduous fibrils over entire lower stipe.

SPORES (6.4-) 7.4-8.3 (-9.8) x (4.5-) 5.0-5.6 (-6.4) μ m, dark brown, ellipsoid, hilar appendix rather prominent, germ pore not evident. BASIDIA 18-24 x 9-10.5 μ m, mostly clavate, tetrasporic; sterigmata 2-4 μ m long. CHEILOCYSTIDIA 9-22.5 x 7.5-13.5 μ m, basidiole-like or globose to ovoid or irregular, in scattered clusters, basidia also present on lamellar margin. PILEIPELLIS of sub-parallel to interwoven, smooth, thin-walled hyphae, appearing hyaline under oil at 1000x, cells 4-9 x 27-100 (-175) μ m, cylindrical or constricted at septae, some with swellings to 17 μ m broad.

CHEMICAL REACTIONS: KOH yellow; aniline x HNO₃ quickly orange to scarlet; 2,4-dinitrophenylhydrazine orange within 10 sec; o-tolidine quickly blue everywhere.

Solitary to gregarious under mixed conifers. Known from Mendocino County, California north along the coast into Oregon. Oct. - Nov. (-Jan.). Common in Humboldt County.

Material studied: CALIFORNIA. Del Norte Co.: H. D. Thiers 21342; D. Showers 20 Oct. 1972. Humboldt Co.: R. W. Kerrigan 748-751, 762, 763, 767, 772, 1118; H. D. Thiers 21342, 21372, 21494 (holotype), 24356, 24403, 30316, 40373, 41682, 43837. Mendocino Co.: R. W. Kerrigan 582, 815; H. D. Thiers 40475, 43801.

Observations: Except for the orangish pigment in the pileipellis, A. smithii might be mistaken in the field for the abruptly-bulbous form of A. silvicola (Vitt.) Pk. The much larger spores of A. smithii also permit separation of the above two species.

This species is named for Dr. A. H. Smith, who first (1940) called attention to the existence of this mushroom under the name A. perrarus Schulz., a European fungus. Most modern European authors treat A. perrarus as a synonym of, or a color variant of, A. augustus Fr. Smith, however, showed that his material was clearly different from A. augustus, therefore a new name is necessary for this apparently endemic species.

Agaricus summensis sp. nov.

Fig. g.

Pileus 15-20 cm latus, hemisphaericus demum subplanus, undulatus, appresso-fibrillosus; fibrillae ochraceae; contextus albus, immutabilis, odor amygdalinus; stipes 11-18 cm longus, 3 cm crassus, deorsum 4.5-5 cm crassus, clavatus, e farcto cavus, albus dein lutescens; vela alba, pendentia; spores (5.6-6.0-) 6.7-7.2 (-8.3-9.0) x (3.4-4.1-) 4.4-4.6 (-5.3) μ m; basidia 19-24 x 7-8 μ m, tetraspora; cheilocystidia 12-18 x 5.5-11 μ m, ellipsoidea vel cylindrica. Holotypus: R. W. Kerrigan 661, Castle Rock State Park, Santa Clara Co., California. 6 March 1977. SFSU.

PILEUS 15-20 cm broad, hemispherical becoming broadly convex or somewhat truncate, finally semi-plane, undulating, margin often splitting; surface dry, appressed-fibrillose, the fibrils ca. 10 mm long, colored yellowish becoming ochraceous, near "Ochraceous-Tawny;" background color whitish; context white, unchanging, firm, to 2 cm thick, odor almond-like.

LAMELLAE free, close, to 1.5 cm broad, pallid, sometimes becoming slightly pinkish, finally dark blackish brown.

STIPE 11-18 cm long x 3 cm above, 4.5-5 cm below, clavate or occasionally bulbous; interior white, or yellowish near base, unchanging, slightly lustrous, narrowly stuffed-hollow; surface glabrous, or with scant, obscure fibrils below, white becoming buffy-yellowish; base rather deeply rooted in substrate.

VEILS forming a white, subapical to suprmedian, pendant annulus, dehiscing from pileus margin late during expansion, then collapsing; upper surface (partial veil) rugose; lower surface (universal veil) breaking up via radial fissures into broad, somewhat obscure, rough-surfaced patches, also sometimes leaving scant floccules on surface of lower stipe.

SPORES (5.6-6.0-) 6.7-7.2 (-8.3-9.0) x (3.4-4.1-) 4.4-4.6 (-5.3) μ m, dark brown, ellipsoid, hilar appendix not prominent, germ pore not evident. BASIDIA 19-24 x 7-8 μ m, clavate, tetrasporic; sterigmata 2-4 μ m long. CHEILOCYSTIDIA 12-18 x 5.5-11 μ m, ellipsoid, cylindrical, or irregular, occurring in clusters, narrow hyphae oriented parallel to lamellar margin also present. PILEIPPELLIS of parallel, smooth, thin-walled, hyaline hyphae, cells 2.5-6 (-10.5) x 65-180 μ m, cylindrical.

CHEMICAL REACTIONS: KOH yellow; aniline x HNO_3 quickly scarlet.

Solitary or in pairs, in litter of Pseudotsuga (with Quercus present or not) and apparently also under Sequoia, on slopes or summits of the Coast Range in the San Francisco Bay region. (Dec.-) Jan. - Mar. Rare.

Material studied: CALIFORNIA. Marin Co.: R. W. Kerrigan 1210. Alameda Co.: R. W. Kerrigan 971. Santa Clara Co.: R. W. Kerrigan 661 (holotype), 662.

Observations: The large size, ochraceous, fibrillose pileus and spore size distinguish A. summensis. It might be mistaken in the field for a very robust specimen of A. silvicola which had discolored in age; however the tawny color of the pileus fibrils in A. summensis appears to be due to the presence of a true pigment in the hyphae of the pileipellis. The fibrils can, however, be indistinct, and the pigment may be slow to develop. The spores of A. summensis are longer than those of A. silvicola and other similar species. The European A. fissuratus (Møll.) Møll. has a very similar aspect, but has larger spores, a pastoral, maritime habitat, and apparently can discolor but lacks pigmentation in the pileus.

Agaricus perobscurus sp. nov.

Fig. h.

Pileus 8-17 cm latus, hemisphaericus vel subtruncatus demum planus, appresso-fibrillosus vel squamulosus, perobscure fuscus, sub fibrillis albidus vel subaurantius; contextus albus, immutabilis; odor amygdalinus; stipes 8-13 cm longus, 1.4-2.5 cm crassus, deorsum 2.5-3.5 cm crassus, bulbosus, e farcto cavus; vela pendentia, alba, tenuia; sporae (5.3-) 6.4-7.4 (-9.0) x (3.8-4.1-) 4.3-4.7 (-6.0) μ m; basidia 17-30 x 7.5-9 μ m, tetraspora; cheilocystidia 9-20 x 7-15 μ m, clavata, oblonga, vel subglobosa, interdum catenulata. Holotypus: H. D. Thiers 19004, Sunset Avenue, San Francisco Co., California. 24 April 1967. SFSU.

PILEUS 8-17 cm broad, at first hemispherical to convex, later often somewhat truncate with a broad disc, finally plane; surface of appressed fibrils which in age form small (ca. 3-5 mm long x 1-3 mm broad), pointed to slightly areolate, appressed-fibrillose squamules colored dark brown, "Olive-Brown" to "Clove Brown" or "Fuscous," or in age about "Sayal Brown;" background color usually predominating after expansion, at first whitish to "Pale Vinaceous-Fawn," in age becoming somewhat "Light Ochraceous-Salmon" to "Cinnamon-Buff," then surface often appearing somewhat polished; context white, unchanging, 1-2 cm thick, odor faintly to moderately of almonds.

LAMELLAE free, close, to 1 cm broad, at first pallid, then "Pinkish Buff" or "Fawn Color," later dark blackish brown, margin pallid.

STIPE 8-13 cm long x 1.4-2.5 cm broad above, 2.5-3.5 cm at the bulbous base; interior white, unchanging or becoming somewhat yellow below, slightly lustrous, stuffed-hollow; surface glabrous above, with thin appressed-fibrillose velar zones below, white, in age often appearing smooth, polished; base shallowly rooted in well-decomposed leaf/needle litter.

VELLS forming a thin, entire, pendant, subapical to supramedian, white annulus composed mainly of partial veil, upper surface nearly smooth; universal veil present as thin marginal patches colored medium brown, "Avellaneous" to dark brown, "Fuscous" on the minutely fibrous to rimose-floccose whitish or later orangish undersurface of annulus, also leaving white to greyish, "Clay Color" velar zones on lower stipe.

SPORES (5.3-) 6.4-7.4 (-9.0) x (3.8-4.1-) 4.3-4.7 (-6.0) μm , dark brown, ellipsoid to elongate, hilar appendix not prominent, germ pore not evident. BASIDIA 17-30 x 7.5-9 μm , clavate or cylindroclavate, tetrasporic; sterigmata 3-6 μm long. CHEILOCYSTIDIA 9-20 x 7-15 μm , basidiole-like or oblong to subglobose, rarely catenulate, in scattered clusters, lamellar margin also composed of basidia and narrow hyphae oriented parallel to margin. PILEIPPELLIS of parallel or sub-parallel to interwoven, smooth, thin-walled hyphae, appearing light brown under oil at 1000x, cells 6.5-9 (-12) μm x 35-80 (or more in age) μm , cylindrical or constricted at the septae.

CHEMICAL REACTIONS: KOH yellow; aniline x HNO_3 slowly or quickly orange to scarlet; 2,4-dinitrophenylhydrazine orange-red in 10 sec; o-tolidine quickly blue everywhere, becoming reddish-black on context.

Solitary to gregarious in litter/soil under various (usually planted) trees, fairly common under Cupressus macrocarpa, occasional under Pinus, Quercus, Eucalyptus, and perhaps others, in the San Francisco Bay region and possibly southern California as well. Dec. - Apr.

Material studied: CALIFORNIA. Marin Co.: R. W. Kerrigan 883. San Francisco Co.: R. W. Kerrigan 593, 643, 650, 670, 855, 920, 954; H. D. Thiers 19004 (holotype). San Mateo Co.: R. W. Kerrigan 942, 943, 967.

Observations: Agaricus perobscurus may be confused with A. augustus in the field; however the pileus of A. perobscurus is generally darker when young, and more pallid and polished when old, than that of the latter species. The thinner annulus, more scant fibrils on the stipe, and frequently pink lamellae of A. perobscurus are also good field characters which contrast with the corresponding features of A. augustus. The spores of the former species are much smaller than those of the latter. Agaricus subrufescentoides Murr., which is perhaps only a dark form of A. hondensis, is another fungus with a similar aspect which is seldom encountered in California but is more common further north; unlike A. perobscurus it has a negative aniline x HNO_3 reaction and a phenolic odor.

ACKNOWLEDGMENTS

I am deeply grateful to Dr. Harry D. Thiers for the years of patient encouragement and advice which he has so generously given to me, and additionally for his critical comments on this manuscript. I also thank Mrs. Ellen Thiers for rendering the diagnoses into Latin, and for her advice on this subject, Dr. David Farr of the National Fungus Collections for searching for prior synonyms of the above new combinations, and Dr. Clark Rogerson and Dr. Rupert Barneby of the New York Botanical Garden for suggesting the epithet "rubronanus." Finally, I am indebted to many collectors, amateur, student, and professional, who helped to bring to my attention certain of the collections and data mentioned above.

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