

*pulcherrimus* is readily distinguished from *B. satanas* and all other red-pored boletes by the dark reddish brown, tomentose to fibrillose pileus, the dark red colored pores, and the clavate to subbulbous stipe which is colored pale reddish brown and has dark red reticulations on the surface. Microscopically *B. pulcherrimus* is further distinguished by having a trichodermium in which the hyphal walls are noticeably roughened and by having spores up to 16  $\mu\text{m}$  in length and to 6.5  $\mu\text{m}$  in width. It should also be noted that in California *B. satanas* seems to form mycorrhizal associations exclusively with coastal live oaks (*Quercus agrifolia*) in the coastal forests and with various other oaks such as California black oak (*Quercus kelloggii* Newb.) canyon oak (*Quercus chrysolepis* Liebm.) or interior live oak (*Quercus wislizenii* A. DC.) in the foothills and Sierra Nevada. *Boletus pulcherrimus*, on the other hand, has never been found associated with any oak and has only been found in mixed forests composed largely of tanbark oaks (*Lithocarpus densiflora* (H. & A.) Rehd.), Douglas fir (*Pseudotsuga menziesii* (Mirb.) Franco) and giant fir (*Abies grandis* (Dougl.) Lindl.)

As mentioned earlier a third member of this complex of red-pored boletes has been found, often abundantly, in the Sierra Nevada at elevations from 5,000 to 7,500 feet. This third species is obviously distinct from both *B. pulcherrimus* and *B. satanas* but is perhaps closer in appearance to *B. satanas*. A description of this species is given below.

**Boletus haematinus** Halling, sp. nov.<sup>2</sup>

FIG. 3

Pileus 11–16 cm latus, convexus demum late convexus, siccus, glaber demum fibrillosus vel rimoso-areolatus, cervinus vel fuscus, saepe rufotinctus. Contextus 3–6 cm crassus, flavus, caerulescens. Sapor et odor mites. Tubuli 1–1.5 cm longi, flavi, caerulescentes; pori primo flavi deinde rosei demum haematini sed ad marginem pilei constanter flavi, caerulescentes. Stipes 5–11 cm longus, 4.5–7 cm latus, aequalis vel interdum clavatus vel subbulbosus, siccus, reticulatus, e flavo subflavidus vel albidus. Sporae 12–15  $\times$  6–7.5  $\mu\text{m}$ , ellipoideae vel subfusiformes, leves. Cystidia 40–45  $\times$  7.5–9  $\mu\text{m}$ , rara, obclavata vel ventricoso-rostrata. Hyphae cuticulate intertextae spiraliter incrustante, punctatae. Gregarius vel sparsus sub arboribus coniferis montium. Holotypus: prope Yuba Pass, Sierra Co., California, Sept. 20, 1975, Halling 812 (SFSU).

Pileus (6–)11–16(–25) cm broad, spherical to convex when young, becoming pulvinate to plano-convex in age, irregular in outline; surface dry, often undulating and pitted, glabrous when young soon becoming appressed fibrillose and rimose-areolate in aged specimens; color during all stages light brown ("dark blonde" to "clay" to "oak brown"), occasionally bruising dark brown ("snuff" to "sepia") on the disc when

<sup>2</sup> Color names in quotations from Kornerup and Wanscher, Methuen Handbook of Color.



FIG. 3. *Boletus haematinus*. One-quarter natural size.

young, areoles becoming dark brown ("snuff" to "raw umber") in old basidiocarps, frequently with reddish tinges ("madder red" to "red" to "rosewood") along the margin and occasionally this color present over most of the surface; margin incurved when young, decurved when older. Context 2–6 cm thick, solid, yellow ("yellow" to "light yellow" to "pastel yellow"), changing to blue upon exposure to the air, eventually fading; taste none to mild, odor none to mild.

Tubes (0.5–)1–1.5(–3) cm long, adnate when young becoming depressed around the stipe with age, yellow ("yellow" to "light yellow") when young, darkening to greenish yellow ("olive yellow") in aged basidiocarps, changing to blue-green when exposed or injured; pores small, less than 1 mm broad, angular, bright yellow ("buttercup yellow") when young, becoming pale red ("yellowish red" to "paprika") then dark red ("ox-blood red" to "Cuba" to "garnet red" to "paprika") darkening to dark reddish brown ("caput mortuum") when old and past maturity, nearly always remaining yellow ("orange yellow" to "cadmium yellow" to "buttercup yellow") at the pileus margin, turning blue when bruised or injured.

Stipe 5–11 cm long, (2–)4.5–7 cm broad at apex, clavate to subbulbous (not abruptly so) when young and immature, more frequently equal throughout all stages of development, occasionally pinched at the base, solid; surface dry, finely reticulate one-half to two-thirds the distance to the base; background color yellow ("cadmium yellow" to "chrome

yellow" to light "orange yellow") when young, fading to pale yellow ("golden blonde" to "milk white") when mature, reticulations pale red ("madder red" to "pastel red"), occasionally breaking up and appearing granulose, base staining brown when handled, not bluing when bruised. Context yellow as in the pileus, bluing upon exposure except in the base.

Spore print brown ("olive brown") when dry. Spores 12–15 × 6–7.5  $\mu\text{m}$ , subfusiform and inequilateral in profile, elliptical to fusiform-elliptical in face view, smooth, moderately thick-walled, pale ochraceous in KOH, ochraceous in Melzer's. Basidia 25.5–39 × 10.5–13.5  $\mu\text{m}$ , 4-spored, hyaline and sometimes guttulate in KOH, clavate, hymenium not amyloid. Hymenial cystidia 40–45 × 7.5–9  $\mu\text{m}$ , hyaline in KOH, obclavate to ventricose-rostrate, rare to infrequent, buried in the hymenium. Tube trama divergent from a central strand, hyaline in KOH. Pileus context interwoven, homogeneous, hyphae 3.75–7.5  $\mu\text{m}$  wide, hyaline in KOH, septa not amyloid. Pileus cuticle differentiated as a trichodermium of tangled, repent hyphae, hyaline to pale ochraceous in KOH, rusty-brown in Melzer's, heavily incrusted in punctate or spiral fashion, incrustations up to 1.5  $\mu\text{m}$  thick, hyphae 4.5–7.5  $\mu\text{m}$  diam. Stipe cuticle differentiated as a palisade of fertile basidia, basidioles, and caulocystidia, all hyaline in KOH, similar to those found in the hymenium; reticulum composed of clavate to obclavate hyphal tips. Clamp connections absent.

Chemical reactions. Unknown.

*Habit, habitat and distribution.*—Gregarious to scattered and occasionally subcespitosse in soil under firs and pines, often covered with duff. Because the apparent mycorrhizal associate of *B. haematinus* is red fir (*Abies magnifica* A. Murr.) the species appears to be limited in distribution to subalpine forests. At present *B. haematinus* is known only from California but probably also occurs in Oregon and Washington.

*Material studied.*—Amador Co.: Edelbrock 18, Halling 49, Thiers 32973; El Dorado Co.: Thiers 32513; Fresno Co.: Halling 798, Thiers 34969; Sierra Co.: Halling 812 (Type), Thiers 13218, 13239, 34918; Tehama Co.: Showers 2894; Tuolumne Co.: Thiers 21108, 32487 (SFSU).

*Discussion.*—This fungus is distinguished from *B. satanas* by the different mycorrhizal associate, the absence of an exaggerated bulbous stipe, and no gray color on the pileus or pink color tones on the stipe. Also, the septa of the hyphae of the pileus trama are not amyloid and the spores are larger. *Boletus haematinus* is, in some ways, superficially

reminiscent of *B. pulcherrimus* but differs in the shape and color of the stipe, the yellow color of the pores when young, the mycorrhizal associate, and the absence of the reddish brown coloration in the pileus. Also, the relatively strong amyloid reaction of the hymenium seen in *B. pulcherrimus* is lacking in *B. haematinus*. Thiers (4) cites two collections (Theirs 13218 and 13239) as *B. eastwoodiae* and one collection (Thiers 21108) as *B. satanas*, but these three collections do not possess the proper characters for those taxa and should be changed to *B. haematinus*.

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