Type studies of corticioid Hymenomycetes (Basidiomycota) with aculei

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Type specimens of ten, resupinate, corticioid basidiomycetes with aculei described by various authors were examined. Five species are later synonyms: Acia conferta P.H.B. Talbot (= Phanerochaete subquercina), Hydnum squalinum Fr.: Fr. (= Cerrena unicolor), Melzerodontia udamentiens P. Roberts (= Phlebia badia), Mycoleptodon lubarskii Pilát (= Hydnophlebia chrysorhiza), Odontia griseo-olivacea Höhn. (= Phlebia uda). The new combination, Scopulodontia webbii (= Hydnum webbii Berk.), is proposed. Phaeoradulum guadelupense Pat. is a species of unknown affinities. Three species were tentatively identified to species: Hydnum bresadolae Quél. (= Dentipellis cf. fragilis), Hydnum stalagmodes Berk. & M.A. Curtis (= Phlebia cf. fuscoatra), and Odontia palumbina Höhn. (= Scopuloides cf. rimosae). The misapplication of the name Hydnum squalinum is discussed.

Keywords: Hydnum limonicolor, Odontia latemarginata, Odonticium monfraguense, Odonticium flavicans.

Corticioid basidiomycetes that develop aculei are numerous and often challenging to identify to species. The term aculei refers to fertile protuberances of all types, sizes, shapes, textures, and colors. Although many corticioid basidiomycetes with aculei are well-studied and well-known, there are still a number of overlooked species. This paper is the result of an on-going study of resupinate, corticioid basidiomycete type specimens; previous studies focused on types of Patouillard (Nakasone 2003) and Bresadola (Nakasone 2008). In this paper type studies of ten poorly known aculeate corticioid basidiomycetes described by several mycologists are studied. One new combination are proposed, and five names are found to be taxonomic synonyms. The taxa originate from Austria, Brazil, Cameroon, Guadeloupe, Italy, Japan, Philippines, Russia, Sweden, and South Africa.

Materials and Methods

Thin, freehand sections from basidiomata were mounted in a mixture of aqueous potassium hydroxide (2 % w/v) and aqueous phloxine
(1 % w/v) or Melzer’s reagent (Kirk et al. 2001) and examined with an Olympus BH2 compound microscope. Cyanophilic of basidiospore and hyphal walls were observed in a solution of cotton blue (0.1 % w/v in 60 % lactic acid). Drawings were made with a camera lucida attachment. Q-values were obtained from dividing average basidiospore length by width (Kirk et al. 2001). These values are approximate as the basidiospore sample sizes are small because of the condition and precious nature of the type specimens. If fewer than six spores were measured in a specimen, the Q-value was not calculated. Capitalized color names are from Ridgway (1912), and other color names follow Kornerup & Wanscher (1978). Herbarium designations are from Holmgren & Holmgren (1998). CortBase (Parmasto et al. 2004) and the Aphyllophorales database at CBS (http://www.cbs.knaw.nl/databases/aphyllo/database.aspx) were consulted frequently throughout this study. Literature citations follow Stafleu & Cowan (1976) for books and Bridson & Smith (1991) and Bridson (2004) for journals.

**Taxonomy**

*Acia conferta* P.H.B. Talbot, Bothalia 6: 64. 1951. –Fig. 1.

= *Phanerochaete subquercina* (Henn.) Hjortstam


Basidioma resupinate, effuse, 85 × 30 mm, adnate, subcereaceous, spinose, Buckthorn Brown, Tawny Olive, or brown [6(D–E)6], extensively cracked between aculei; aculei terete, up to 1 mm long, 3–4 aculei per mm, single or fused at base, apex obtuse with multiple, small tufts; margin fimbriate, appressed. Hypothallus monomitic with simple-septate generative hyphae. Subicular hyphae (Fig. 1A) 2–5 µm diam, simple septate, moderately branched, walls hyaline, thin, smooth. Hymenium a dense palisade of immature basidia. Mature basidia not observed. Basidiospores (Fig. 1B) ellipsoid, (5.3) 5.4–6.2 (6.5) × (3) 3.1–3.4 (3.5) µm, Q = 1.7 (n = 7), walls hyaline, thin, smooth, not reacting in Melzer’s reagent.

*Acia conferta* is conspecific with *Phanerochaete subquercina*. In addition, three paratype specimens named *A. conferta* (PREM 40524–40526) were examined. These have clamp connections and subfusiform cystidia and may be conspecific with *Phlebia subceracea* (Wakef.) Nakasone.


= *Dentipellis* cf. *fraglis* (Pers.: Fr.) Donk


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Basidioma consisting of two small pieces, ca. 4 × 3 and 3 × 2.5 mm, resupinate, effuse, subceraceous, spinose, fragile, brittle, light brown (6D6); aculei slender, narrowly conical with an acute apex, 430–750 × 70–90 µm; margin not observed. Hypal system monomitic with clamped generative hyphae. Aculei composed of agglutinated tramal hyphae arranged in parallel; tramal hyphae 1.5–2 µm diam, clamped, walls hyaline, thin, smooth, possibly cyanophilous. Context and hymenium degraded; subiculum, subhymenium basidia and cystidia not observed. Basidiospores abundant, broadly ellipsoid, usually collapsed, (4) 4.8–5.6 (5.8) × (3.2) 3.9–4.3 (4.5) µm, Q = 1.3 (n = 9), walls hyaline, thin to slightly thickened, smooth in KOH and phloxine, minutely warted or roughened in Melzer’s reagent, acyanophilous, amylloid.

Later, but not in the protologue, Bresadola (1882, p. 26) noted that the basidiospores of *H. bresadolae* were echinulate. His illustration (Bresadola 1881, plate 11, fig. 2) shows a basidioma with numerous aculei and a pallid, distinctly cottony or fibrous margin. Because of the fragmentary and degraded condition of the holotype, it was not possible to identify this specimen with certainty. It appears most similar to *D. fragilis* with respect to basidiospore shape and size. However, the short aculei and coniferous substrate of the holotype of *H. bresadolae* differ from the description of *D. fragilis* by Ginns (1986).

Mycologists have differing opinions on the status of *H. bresadolae*. Quélet (1888, p. 433) considered *H. bresadolae* to be similar to *H. limonicolor* Berk. & Broome, whereas Bourdot & Galzin (1928, p. 411) placed both species in synonymy with *Sistotrema muscicola* (Pers.) S. Lundell. Legon & Henrici (2005, p. 393), however, consider *H. limonicolor* a nomen dubium. Hjortstam (1987, p. 75) believed *H. bresadolae* to be congeneric with *Mycoacicia* but did not formally make the transfer.

In addition to the holotype, two other specimens of *H. bresadolae* from S, F106889 and F15772, possibly from the same gathering as the holotype, were examined. Both these specimens consisted of woody fragments but no basidiomata with aculei were observed. A single collection labeled *H. bresadolae*, Tyrol meridional, Sept 1881, from L. Quélet’s herbarium at PC was examined. This specimen has simple-septate hyphae and smooth, amylloid, ovoid basidiospores and appears to be a species of *Mucronella*.

**Hydnum squalinum** Fr.: Fr., Syst. mycol. 1: 420. 1821.
- *Sistotrema squalinum* (Fr.: Fr.) Persoon, Mycol. Europe 2: 199. 1825, as ‘squalidum’.
- *Acia squalina* (Fr.: Fr.) P. Karst., Medd. Soc. Fauna Fl. Fenn. 5: 42. 1879, as ‘squalida’.
≡ Cerrena unicolor (Bull.: Fr.) Murrill


Hydnum squalinum has been misinterpreted by many mycologists and has a long, confusing history. The holotype is at UPS in Herb. Fries with notes by Romell who identified it as Daedalea unicolor (Bull.: Fr.) Murrill (Maas Geesteranus 1974, p. 465). This specimen is effused-reflexed with an irpicoid hymenophore and dimitic hyphal system with clamped generative and thick-walled skeletal hyphae. The hymenium is degraded and only a single, cylindrical basidiospore (6.3 × 2.7 µm) was seen. The isotype specimen at BPI is similar except that no basidiospores were observed. On this packet is written ‘Hydnum squalinum orig!, Femsjö, Fries’ in Fries’ hand. Because there is nothing in the holotype and isotype specimens to contradict Romell’s conclusion, I accept his identification.

There is no consensus among mycologists on the correct application of the name H. squalinum. The confusion began with Fries (1838, p. 515) who placed Boletus obliquus Bolton in synonymy with H. squalinum and suggested that Hydnum fuscescens (Schwein.) Spreng., Sisotrema taurinum Pers., and S. fagineum Secr. may be considered varieties. However, B. obliquus is generally accepted as a synonym of Serpula lacrymans (Wulfen: Fr.) J. Schrot. (Fries 1821, p. 328), H. fuscescens a synonym of Hydrochaete olivacea (Schwein.: Fr.) Banker (Banker 1914), and S. taurinum a species of Mycoleptodon, now Steccherinum (Bourdot 1932). Bresadola (1897, p. 94) concluded that “Hydnum squalinum aut. Pl. non Fr.” was a synonym of Hydnum macrodon Pers., usually interpreted to be Dentipellis fragilis. Later, Rea (1922) misapplied the name H. squalinum to the species known as Mycoaciella bispora (Stalpers) J. Erikss. according to Legon & Henrici (2005). Also, Bourdot & Galzin’s (1928) concept of Acia squalina was erroneous. Michel & Duhem (2003) studied all five specimens of A. squalina in Bourdot’s herbarium at PC and identified both of the de Crozals specimens (PC 39099, 39103) as Odonticium monfraguense M.N. Blanco et al. (= Odonticium flavicans (Bres.) Nakasone) and the other three specimens (PC 31450, 32346, 33072) as Phlebia badia (Pat.) Nakasone. I have examined the same five specimens from Bourdot’s herbarium and concur with Michel and Duhem’s identifications. Finally, Christiansen (1960) described Mycoacia squalina from Denmark, but he misapplied the name to specimens of Sarcodontia crocea (Schwein.) Kotl. according to Legon & Henrici (2005) and Hansen & Knudsen (1997).

== Phlebia cf. fuscoatra == (Fr.: Fr.) Nakasone


Basidoma resupinate, effuse, ceraceous, hydnaceous, brown [6D(7–8), 7E8]; aculei conical, slender, tapering to apex, 3–4 mm long, 3–4 aculei per mm, fused together into larger clusters, dark brown with a hygrophanous appearance, often glaucous from crystalline materials on surface, sometimes with embedded columns of pale yellow, crystalline materials. Hypha 1 system monomitic with clamped generative hyphae. Aculei composed of fascicles of agglutinated tramal hyphae and embedded crystals, no hymenial layer observed; tramal hyphae 2.5–3.5 µm diam, clamped, walls hyaline, thin, smooth. Hymenium degraded, basidia and cystidia not observed. Basidiospore, only one observed, cylindrical, 7 × 2.5 µm, wall hyaline, thin, smooth, not reacting in Melzer’s reagent.

Because of the poor condition of the specimens, it is impossible to make an identification. Based primarily on macroscopic features, H. stalagmodes is Phlebia fuscoatra. This would be consistent with Berkeley’s observation that it was “somewhat like Hydnum membranaceum and udum,” since P. fuscoatra was often identified as H. membranaceum by mycologists. Maas Geesteranus (1974, p. 567), however, suggested that H. stalagmodes was a heterobasidiomycete.

Hydnum webbii Berk., Journal Botany, London 3: 190. 1844. - Fig. 4.

== Scopulodontia webbii == (Berk.) Nakasone, comb. nov.

Mycobank no.: MB 515512


Basidoma resupinate, effuse, broken into smaller pieces about 12–18 × 7 mm, adnate, ~360 µm thick excluding tubercules, ceraceous to corneus, tuberculate, dark brown, dark gray to light brown, covered with a fine, white bloom; tubercules (Fig. 4) with rounded apices, about 470 × 180 µm, 3–4 tubercules per mm, finely velutinous from projecting cystidia but shiny where rubbed-off; margin not observed. Hymenium monomitic with clamped generative hyphae. Subiculum ~180 µm thick, a compact, agglutinated tissue of indistinct hyphae; subicular hyphae 4–5.5 µm diam, walls yellow, thin to thick. Subhymenium up to 180 µm thick, an agglutinated, compact matrix with embedded crystals, metuloid cystidia, and scattered lacunae. Hymenium degraded, only metuloid cystidia observed. Cystidia numerous throughout context and hymenium, fusiform, 35–42 × 8–10 µm,
clamped at base, walls hyaline, thin or thickened at base, heavily encrusted over upper half with hyaline crystals. Basidia and basidiospores not observed.

Although basidia and basidiospores were not observed in the holotype and isotype specimens, there can be no doubt that this taxon is conspecific with *Odontia latemarginata* Pat. Maas Geesteranus (1974, p. 569) also did not observe basidia and basidiospores in the holotype. The rounded, finely fuzzy aculei and encrusted, embedded cystidia are characteristic and distinctive for this taxon. Since *H. webbii* is the oldest name for this species, the new combination is proposed above. Nakasone (2003) provides a description and further synonymy. *Phlebia (Mycoacia)* sp., Roberts K344, described from Cameroon (Roberts 2000) is conspecific with *S. webbii*. Known from Vietnam, Brunei, Philippines, and New Zealand (Nakasone 2003), *S. webbii* was reported recently from Ecuador (Hjortstam & Ryvarden 2008).

**Melzerodontia udamentiens** P. Roberts, Kew Bull. 55(4): 819. 2000. - Fig. 5.

= **Phlebia badia** (Pat.) Nakasone

**Holotypus.** - CAMEROON, Southwest Province, Korup National Park, Transect P, on (bark) of part fallen branch, 50 m alt., 4 April 1997, leg. P.J. Roberts K890 (K, K(M)58759).

**Basidium** resupinate, effuse, 20–35 × 20 mm, closely adnate, appressed, thin, ceraceous, odontoid to spinose, aculei brown [6E(7–8)] with a reddish tinge, smooth areas between aculei light orange (5A4), toward margins aculei yellowish brown [5D(6–5)] and smooth areas between aculei light yellow (4A4), extensively cracking on drying to expose pale yellow, homogeneous context; aculei (Fig. 5) slender, terete, up to 1.5 mm long, 3–5 aculei per mm, tapering to an acute point, single or fused laterally at base, with a shiny, smooth surface, apex white or yellow, paler than aculens base; margin thinning out, finely farinaceous, greyish yellow (4C4), outer most edge white, farinaceous or abrupt, smooth, waxy, fibrillose. **Hypysystem** dimitic with simple-septate generative and thick-walled skeletal hyphae. **Aculei** composed of a central core of dextrinoid skeletal hyphae and large, embedded crystals. Hymenium a palisade of cystidia and basidia. **Cystidia** difficult to isolate and observe, clavate, about 13 × 4.5 µm, apically capped with a globular substance. Mature basidia not observed. Basidiospores ellipsoid, (3.5) 3.8–4.2 (4.5) × (1.8) 1.9–2.1 µm, Q = 2.0 (n = 12), walls hyaline, thin, smooth, not reacting in Melzer’s reagent.

**Melzerodontia udamentiens** is conspecific with *Phlebia badia* although the basidiospores in the latter species are somewhat larger, (3.5–) 4.5–5 (–6)× 2–2.5 (–3) µm (Nakasone 2002). *Phlebia badia* is re-
ported from Vietnam, Brazil, Costa Rica, United States (Florida), Iran, and Malawi (Nakasone 2002, Hjortstam & Ryvarden 2004).


= *Hydnophlebia chrysorhiza* (Torr.) Parmasto

**H o l o t y p u s.** - RUSSIA, Primorsk Territory, Asia orientalis, Schkotowo, on Acer mono Maxim., 25 Aug 1935, Ljubarsky (PRM 25042).

Basidioconidiophores resupinate, diffuse, soft, fragile, spinose, aculei easily separated from subiculum, hyphal strands in margin not well-developed. Hyphal system monomitic, generative hyphae simple-septate with scattered single clamp connections. Subicular hyphae 5–9 µm diam, simple-septate with scattered single clamp connections, moderately branched, lateral H-connections observed, walls hyaline, thin, smooth or encrusted with a thin layer of crystals. Hyphum degraded, no cystidia or basidia observed. Basidiospores ellipsoid to cylindrical, (3.5) 3.6–4.4 (4.5) × (2) 2.1–2.4 (2.5) µm, Q = 1.8 (n = 6), walls hyaline, thin, smooth, not reacting in Melzer’s reagent.

The condition of the holotype is poor, but based on my observations and previously published descriptions (Pilát 1936, Nikolajeva 1961, p. 152), I conclude that this taxon is *H. chrysorhiza*. The basidiospores observed are slightly shorter than typical for the species, 4–5 × 2–2.5 µm (Burdsall 1985). According to Maas Geesteranus (1974, p. 558) the isotype at UPS is poorly preserved also. Widely distributed in eastern United States (Burdsall 1985), *H. chrysorhiza* occurs in East Asia also. It is reported from the Ussurian region of Primorsk Territory, Russia (Nikolajeva 1961, as *Sarcodontia fragilissima* (Berk. & M.A. Curtis) Nikol.), Japan (Maekawa 1993), and Sichuan Province in southwestern China (Maekawa *et al.* 2002).


= *Phlebia uda* (Fr.) Nakasone


Basidioconidiophores resupinate, adnate, widely diffuse, up to 30 × 25 mm, thin, subceraceous to crustaceous, odontoid to spinose, smooth between aculei, greyish orange (5B4), light brown [D(4–5)], or brown (6D4), turning dark brown in KOH; aculei slender, cylindrical, up to 0.5 mm long, 2–4 aculei per mm, single but often fused at base, darker brown at base then paler toward apex, apices penicillate to tufted, white; margin thinning out, adnate, fimbriate, light brown to off-white.
Hypahal system monomitic with clamped generative hyphae. Aculei with a core of partially agglutinated, parallel hyphae and acicular crystals, at apex terminal hyphae not differentiated but heavily encrusted with coarse, hyaline crystals; trimal hyphae 2.5–3.2 μm diam, clamped, sparingly branched, walls hyaline, thin, smooth. Subicular hyphae similar to trimal hyphae. Subhymenium up to 25 μm thick, a dense tissue of vertical, short-celled hyphae; subhymenial hyphae 2–2.5 μm diam, clamped, frequently branched, walls hyaline, thin, smooth. Hymenium a dense palisade of immature basidia and cystidia. Cystidia subulate, (12–)18–25 × 3–7 μm, clamped at base, often with an apical, globose cap of yellowish brown, mucilaginous material, 5–10 μm diam. Mature basidia not observed. Basidiospores short cylindrical, (4.7) 4.8–5.2 (5.5) × (2.1) 2.2–2.4 (–2.5) μm, Q = 2.2 (n = 12), walls hyaline, thin, smooth, acyanophilous, not reacting in Melzer’s reagent.

Although the basidiospores are slightly narrower than usual, O. griseo-olivacea is conspecific with Phlebia uda. The holotype is in good condition and turned dark brown with the application of potassium hydroxide, whereas Höhnel (1905) observed a bright violet or lilac color change with ammonia.

Odontia palumbina Höhn., Denkschr. K. Akad. Wiss. Wien, Math.-Naturw. Kl. 83: 10. 1907. – Fig. 6.

= Scopulooides cf. rmosa (Cooke) Jülich


Basidiole a resupinate, effuse, up to 35 × 13 mm, thin, up to 90 μm thick, ceraceous to corneous, odontoid, smooth to finely granulose or scabrous between aculei, brown [63(4–5)], Light Drab to Drab; aculei (Fig. 6) abundant, cylindrical with bristly sides and apices, up to 270 × 90 μm, 4–6 aculei per mm, single or occasionally fused at base; margin abrupt, distinct, adnate or slightly detached on drying, fibrillose. Hyphal system monomitic with simple-septate generative hyphae. Aculei composed of embedded, septate cystidia in the central axis and numerous, protruding and embedded metuloid cystidia; septate cystidia cylindrical and gradually tapering toward apex, up to 75 × 6–11 μm, walls hyaline, up to 1.5 pm thick, lightly encrusted with hyaline granules; metuloid cystidia fusiform, 35–50 × 8–12 μm, tapering to 1.5–3 pm diam toward base, simple-septate at base, walls hyaline, thick, distal end heavily encrusted with coarse, hyaline crystals, partially dextrinoid. Subiculum a dense, agglutinated tissue of collapsed hyphae; subicular hyphae 4–7.5 μm diam, simple-septate, walls hyaline, thin to thickened, smooth. Subhymenium not observed. Cystidia metuloid, as described above. Basidia not observed. Basidiospores
rare, mostly collapsed, allantoid, 2.9–3.6 × 0.7–1.8 μm, walls hyaline, thin, smooth, not reacting in Melzer’s reagent.

This taxon resembles Scopuloides rimosa because of the abundant aculei; however, the basidiospores are smaller than expected for the species. The holotype specimen appears to be in good condition, but only three, questionable basidiospores were seen. The small, ovoid basidiospores, 1–1.5 × 1 μm, described in the protologue were not observed but are possibly the pinched apices of the collapsed, immature basidia.


**Holotype** - GUADELOUPE, sur tige pourissant d’une Daphnopsis caribe Griseb., no. 28 (FH 00258830).

**Phaeoradulum**, a monotypic genus, is unrelated to any of the known resupinate, spinose basidiomycete genera although Hjortstam and Ryvarden (2007) suggested a relationship to the Coniophoraceae. The brown, hard, spinose basidiome with broadly ellipsoid, brown basidiospores are unique to this genus. The hyphae are probably simple-septate, but it was difficult to isolate individual hyphae that were not compressed or distorted. The fragile nature of the cystidia and basidia made it impossible to tease out whole, individual elements and observe if a basal clamp was present.
Figs. 1–3. Line drawings of microscopic elements. 1. *Acia conferta* (holotype): 
A. Subicular hyphae. B. Basidiospores. 2. *Phaeoradulum guadelupense* (holotype): 
A. Cystidia. B. Basidia. C. Basidiospores. 3. Basidiospores of alien agaric in the 
holotype of *P. guadelupense*. 282
The holotype has two distinct types of basidiospores - the broadly ellipsoid basidiospores (Fig. 2C) described above and larger, thick-walled, brown, ellipsoid basidiospores (Fig. 3) with an apical pore. The latter, alien basidiospores are more prominent and abundant. They are possibly from a gilled mushroom species in the Agaricaceae, Bolbitiaceae, Psathyrellaceae, or Panaeoleae. These basidiospores measure (11.5) 11.8–13.6(15) × (7) 7.5–8.9(9) µm, Q = 1.6 (n = 22). In the protologue, Patouillard described the basidiospores as “lisses, ovoides, oc-racbes brunes, 10–12 × 6 µ” but does not mention the presence of an apical pore.

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